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Performance Analysis Combination of Nickel and Zinc Coated Single Point Cutting Tool in Turning Operation

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ABSTRACT

Machining is the heart of any manufacturing industry. For any kind of material like macro to heavy machinery requires machining. Cutting tool requires machining process. Engineers and scientist are working to find out the best technique for increasing the efficiency of machining process.

The cutting tool coating is a process for increasing the performance and productivity in machining process. This thesis work objective is to analyze the performance of single point cutting tool coated with metal (Nickel and Zinc) in the turning operation of aluminum. Single point cutting apparatus utilized for machining cylindrical shaped specimen of aluminum.

Several kinds of tests like depth of cut, feed rates and cutting speed are taken place. The temperature of work piece- tool interface and surface roughness is measured and obtaining the results for MRR. These data helped in analyzing the effectiveness of cutting process. The tool used is HSS and are coated with nickel and zinc separately.

Total 24 tests are completed and comes about are tabulated. The values attained to draw a graph between coated and uncoated cutting tools are finally concluded. The results obtained from turning operation by coated tools are compared with uncoated tool to draw a valid conclusion.

Keywords: *single point cutting tools, tool coatings: zinc and nickel, cutting speed, feed, depth of cut*

I. INTRODUCTION

Machining is the process of removing unwanted material from the work piece in the form of chips. Turning operation is nothing but rotation of work piece against the tool. Chip formed due to shear force acting on the cutting tool. While performing operation heat is generated due to shear force and rubbing action on cutting tool. The generated heat distributed to work piece, tool and chip. The liberated heat effects performance of machining performance. So temperature generated is one of the factor to analyze cutting tool performance in turning operation. Surface roughness is the another parameter to analyze performance of cutting tool.

Tool coating is one of the processes to increase the performance of cutting tool. Many of the researches done experiments done coatings used titanium oxide and titanium nitride, titanium carbide using chemical vapor deposition (CVD) and physical vapor deposition (PVD) methods.

The input parameters are taken for the experiment are cutting speed (N), feed rate (F), depth of cut (d).

II. LITERATURE REVIEW

To increase the quality of product of machined parts were the fundamental test for assembling ventures. This goal requires better administration of the machining framework. This writing incorporates data on temperature in chip-tool interfaces, surface finish and rate of material removal in turning operation and coating materials for cutting tools. Optimum values for cutting parameters are valuable for giving high precision, optimum machining. So we give a try for optimize machining parameter by using tools that are coated. The user should be aware of choosing cutting parameters so that it can limit cutting time, constrain and to accomplish better complete under stable conditions.

It is essential for device materials that need to have high temperature quality. While most earthenware materials like TiC, Al2O3 and TiN have high temperature quality, they have less crack strength when contrasted with customary material tools like rapid steel and solidified tungsten carbides. The machining for hard and concoction responsive materials at more noteworthy rates can be enhanced by applying single and multi layer coatings for regular instrument material for useful properties of joined conventional and artistic apparatus materials.

J.A. Ghani et al. [1] Separated the instrument of wear for uncoated cermets and TiN-secured carbide mechanical assemblies at various varieties of significance of cut, cutting rate and sustain rate for cemented AISI H13 gadget steel. They have seen that time taken for bleeding edge of carbide mechanical assemblies that are TiN-shrouded to start breaking and part is more than that about uncoated cermets gadget, especially at the mixes of high depth of cut, cutting pace and encourage rate at blends of low significance of cut, cutting rate, and feed rate, the uncoated cermets instruments demonstrate more reliable and unfaltering wear on flank stand up to when stood out from the TiN-secured carbide gadgets.

Yong Huang et al. [2] Has ascertained in light of flank wear criteria as far as life of hardware as association for cutting conditions is profundity of cut, bolster and cutting rate. They come to comprehend that cutting rate has an indispensable part in getting the execution of hardware with limitations of life of hardware, trailed by profundity of cut and encourage and general inclinations acknowledge with foreseeing from general taylor instrument life condition and examination perceptions.

Schulz et al. [3] expressed that the bleeding edges for solidified carbide apparatus that are covered with Tin/(Ti,A)N, TiC by utilizing CVD (substance vapor statement) as well as by PVD(physical vapor testimony) procedures will demonstrate an addition of administration lifetime for instruments by a factor of ten contrasted with uncoated devices.

F Akbar et al.[4] studied on the usage of TiN coated tool cause a decrement of warm parcel into slicing apparatus when contrasted with uncoated device around 17% at regular cutting velocity and 60%at HSM district.

Ramamurthy et al. [5] The affidavit states of sputter for DLC/TiN/Ti/Cu/Ni multilayer coatings were distinguished to accomplish high caliber with particular reference to bond and surface wrap up.

K. Subramanyam et al. [6]. In the present work the powerful working about covered instruments amid machining solidifying steel under dry conditions is considered. The test esteems appeared with increase in bolster about the harshness of surface is watched is exceptionally poor. The impression of cutting speed on unpleasantness of surface is generally low when contrasted with encourage rate. With the expansion of profundity of cut, the harshness of surface is expanded. Here trial numbers appears by picking the fitting cutting parameters, that are covered devices are reasonable for creating parts of fine surface wrapped up.

L.B. Abhang et al. [7] it is taken into consideration for measuring temperatures evolved at cutting operations. To calculate cutting temperature at the machining the main techniques that are used thermal radiation, tool-chip thermo couple, embedded thermocouple. The most popular tool that is used for measuring temperatures at metal cutting is tool work thermocouple. In this article apparatus work thermocouple strategy has been utilized for measuring the chip-instrument interface temperature at time of machining of metal like EN-31 steel composite.

M.B.Silva and Wall Bank J. [8] For the development of cutting execution, the information of temperature esteem at the work-apparatus interface with great exactness is fundamental. A few trial and investigative systems have been produced for the count of temperatures developed in cutting procedures. Because of sort of metal cutting, the likelihood for measuring temperature accurately is zero at the cutting zone, and subsequently it is troublesome to verity the hypothetical esteems in exact way. In light of assortment of the metal cutting, acquiring the interior temperatures on cutting apparatus were troublesome. For computing this temperatures acquired at the cutting zone, a few strategies have been created. Calorimetric strategy, thermocouple, infrared photographic method, warm paints and PVD procedure are some of them.

Work-instrument thermocouple is dependably a notable device utilized for measuring temperature amid cutting metal. This apparatus is extremely advantageous to demonstrate impacts of cutting parameters, cutting pace, encourage rate for temperature. Thermocouples are rugged,conductive reasonable and can work at a wide temperature ranges. In machining applications, a thermo electric EMF is produced between the instrument and the work piece. With this technique the whole device is taken as a piece of the thermocouple and work piece as the another part. The cutting zone turns into the hot junction,and the work piece moves toward becoming as chilly intersection. This system is anything but difficult to apply however just measures the mean temperature over the whole contact region for work piece and apparatus. In light of these estimations utilizing the thermocouple technique,

Stephenson [9] expressed that the normal EMF is in instrument work piece interface.

W. Grzesik [10] in valuated the impact of temperature for apparatus work interface temperature, while machining an AISI 1045 and an AISI 304 with devices that are covered devices. The Standard k-sort of thermocouple embedded into work piece will be utilized to figure the interface temperature The erosion on flank confront has tremendous impact era of warmth around 200 m/min cutting rate.

Trent and Wright [11] clarify that 99% of work done will be changed over to warm. This makes in increment of temperatures in instrument and work piece.

Herbert,(**E M Trent, 1989[12]**) planed procedure by utilizing instrument work thermocouple for investigating chip-apparatus interface temperature variety under various conditions, such as cutting rate, profundity of cut, and furthermore with various cutting liquids, cutting fluids. His outcomes demonstrated that with increment in temperature increments of speed from 0.1m/s to 1m/s. additionally, when cutting dry, temperatures are high trailed by cutting with oil, lastly with water as the cutting fluid. As water will be the best conductor for warm in these three decisions, it will give the most reduced temperature, reinforcing water's capacity as great coolant. Which accomplishes up to a 30% to 40% expansion in its cutting pace, while machining steel with rapid steel instruments by utilizing as water coolant. In spite of its superb capacity of cooling water does not have its greasing up properties, and it causes major issues like erosion on machine apparatus parts and on work piece

S. Ramesh et al.[13] has represented measurement, analysis on surface roughness in temperature of turning process for an aerospace aerospace titanium alloy (gr5), under influence of machining parameters like bolster rate, profundity of cut and cutting rate. And they found increase in value of surface roughness with increasing in feed, speed and depth of cut.

NeerajSaraswat et al[14] explained the effects on speed of spindle, depth of cut and feed rate in turning process done on mild steel for surface roughness and which results in the blend of the ideal levels of the elements were gotten to get the most minimal surface harshness.

Astrand et al [15] demonstrated the covering cutting instrument edge geometry and designs can essentially impact warm appropriation in cutting apparatus. The paper shown the potential benefits and role of applying different coats on flank face and rake with regards contact phenomena impact on tool wear and thermal shielding.

Grzesik et al [16] discovered that strategy for basic adjusts for multilayer covered cutting device execution will be more attractive than uncoated apparatuses.

Corduan et al [17] obtained that, PVD coated tool achievement is more desirable than CVD.

Lin et al [18] designated that; feed will have significance factor influence surface harshness took after by cutting pace.

Kelly et al. [19] The machining procedure of aluminum is most essential process on industry. Insignificant grease machining for aluminum combinations break down and upgraded of cutting parameters.

Nouari et al [20] the coating material with diamond allows to increase the life of tool. This combination of the cutting conditions and optimized tool geometry gives high quality of surface finish.

III. EXPERIMENTATION

3.1 Required work piece

A rod of diameter 25 mm made up of aluminum is taken as work piece.

The most commonly used metal is Aluminum for large variety of products like kitchen wear, Automobile, Aircrafts, Jets, etc. Because it has some specific properties like less corrosion effect, more thermal conductivity. In modern manufacturing industries usage of Aluminum is more comparing to other materials its good properties like strengthening & hardening

The Material properties of Aluminum are listed in the below Table 1 and the related geometry of the Aluminum rod to be carried by Fig 1

Table 1 Material properties of Aluminum

Group	13
Period	3
Block	P
Atomic Number	13
Solid State	Solid
Electron Configuration	[Ne] $3s^2 3p^1$
Melting Point (k)	933.473
Boiling Point (k)	2792
Density (g/Cm³)	2.70
Relative atomic Mass	26.982
Key Isotopes	^{27}Al

Fig1: Geometry of the Aluminum Rod

3.2 Preparation of Work piece:

Aluminum rod of 10 centimeter length with fine surface finish is needed for next machining process. The following steps explains making of required work piece.

3.2.1 Cutting into 10 cm pieces:

The rod is made into 10 cm pieces by using hand saw. The aluminum rod is to be held in vice as shown in fig.2

Fig 2: Cutting Aluminum rod into pieces

The cut aluminum work pieces are ready for facing and turning operation is as shown in fig.3

Fig 3: Raw work piece

3.2.2 Facing Operation:

The pieces of aluminum was under give facing operation to get smooth face by using lathe machine shown the below Fig 4

Fig 4: Facing operation

3.2.3 Turning operation:

The faced work-piece is turned with help of lathe machine and approximately 0.9 mm thickness is decreased. The requirement of turning operation is making the external surface of the work-piece to smooth shown in the below Fig 5

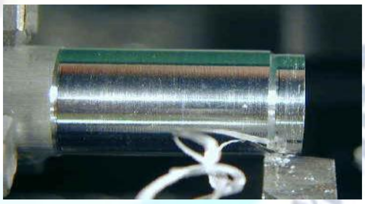

Fig 5: Turning operation

3.3 cutting tool selection

The tool was selected for the experimental purpose is HSS("High Speed Steel").When steel tools contains a mixture of greater than 7 percent molybdenum, tungsten and vanadium, and greater than 0.60 percent carbon, they are said to be as HSS("High Speed Steels"). It is a term which explains about their characteristics to cut metals at very "high speeds".

Lateuntil in 1950's, T-1 having 18 percent tungsten was to be the most qualified machining steel, however the progression of controlled conditions warm treating heaters made it commonsense and the cost is viable to substitute part or the greater part of the tungsten with molybdenum. Additions of 5-10 percent Mo successfully expands the hardness nature and sturdiness nature for rapid steels and let keeps up these properties at the high temperatures produced when cutting metals. Molybdenum gives another preferred standpoint: at high temperature, steels mollify and progress toward becoming embrittled if the essential carbides of iron and chromium develop quickly in measure. Molybdenum, for the most part with blend of vanadium, limits this by making the carbides to change as little auxiliary carbides which are more steady at high temperature. The significant utilization for fast steel is for assembling of various cutting apparatuses: like drills, processing cutters, saw blades, gear cutters, processing cutters and so forth.

The required cutting attributes for fast steels have been overhauled by taking dainty, yet overwhelmingly hard, titanium carbide coatings which can decrease grinding and increment wear resistance, along these lines incremental of cutting velocity also life of the apparatus.

3.4 Preparation of cutting tools:

Single point cutting tools used for high speed steels is coated with Nickel & Zinc on individually by using electrochemical plating. The experimental phenomena of coating process are shown in Fig 6 & 7

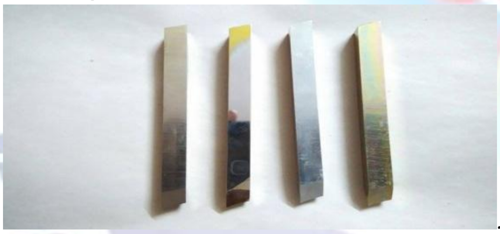

Figure 6 Single point HSS cutting tool (Left to right: Uncoated, Ni coated, Zn coated and cadmium dipped tool)

Figure 7 Electrochemical coating on cutting tools

3.5 machining operation and measurement

After preparation of the work-piece and tool material next step is to perform the turning principle operation on the work-piece with the selected values of speed, depth of cut and feed. The experimental setup in real time during turning process is shown in Fig 8.

Figure 8 Experimental set up for turning

In turning process the pyrometer is used for calculating the temperature of tool-chip interface and obtained value is noted. The infrared thermometer used for measuring temperature during experimentation is shown in below Fig 9.

Figure 9 Infrared thermometer

Fig.10 shows the work-pieces after turning process which are ready to measure surface roughness.

Figure 10 Machined work-pieces

After turning process, surface roughness measuring instrument is used to check the roughness value in machined work-piece.

3.4 Calculation of Material Removal Rate:

MRR can be characterized as aggregate volume of material expelled from work-piece per unit time. MRR is a criteria to investigate the nature of result of a machining procedure.

For turning operation, if

'f' is the feed value in mm/rev,

'd' is depth of cut in mm

And 'D' is diameter of work-piece in mm

Then MRR (or) volume of removed material from work-piece per unit revolution is given by

$$MRR = \pi.f.d.D\frac{mm^3}{rev}$$

If 'N' is speed of work-piece in RPM, then the volume of the material removed from work-piece per minute is

$$MRR = \pi.f.d.D.N\ mm^3/min$$

Using this standard relation MRR for turning operation can be calculated

IV. RESULTS AND DISCUSSION

The results obtained of modelled problem and its experimentation is listed and analyzed to obtain a valid conclusion. Two experiments are conducted on the combination and variation of different input parameters. The following are below

4.1 Machining Parameters:

Experimentation 1:

The table 4.1 shows the numerical values for various machining parameters like cutting rate, speed rate, encourage rate and the profundity of cut for experimentation.

Table 4.1: Parameters of different cutting speeds

Cutting spee N (rpm)	Depth of cu d(mm)	Feed F (mm/rev)
100	0.35	0.080
140	0.65	0.144

4.1.1 Experimental Result:

In the following table 4.2 the experimental result of turning aluminum work-piece with multiple tools in dry conditions.

Table 4.2: Experimental result for turning operation of uncoated tool made up of Aluminum

S.N o	Diamet er (D)mm	Feed (f) mm/r v	Spe d (S) rpm	Dept h Of cut (d)m m	Temperatu re (T)°C	Surface roughne ss Ra(µm)	MRR (mm^3/m n)
1	23	0.080	100	0.35	32.5	1.290	202.32
2	23	0.080	100	0.65	35	1.901	375.73
3	23	0.080	140	0.35	35	1.990	283.25
4	23	0.080	140	0.65	36	2.020	526.03
5	23	0.144	100	0.35	37.5	1.201	364.17
6	23	0.144	100	0.65	38.5	1.29	676.32
7	23	0.144	140	0.35	38	1.401	509.84
8	23	0.144	140	0.65	39.5	1.301	946.85

Table 4.3 Experimental results of turning Aluminum with Nickel coated tool

S.N o.	Diame ter (D)m m	Feed (f) mm/r ev	Spe d(S) Rpn	Depth of Cu (d) mm	Tempe rature (T)°C	Surfac e rough ess Ra(µm	MRR (mm^3/ min)
1	23	0.080	100	0.35	35.5	0.901	202.32
2	23	0.080	100	0.65	37.4	0.812	375.73
3	23	0.080	140	0.35	35.5	0.998	283.25
4	23	0.080	140	0.65	39.9	1.354	526.03
5	23	0.144	100	0.35	38.1	1.939	364.17
6	23	0.144	100	0.65	37.4	2.14	676.32
7	23	0.144	140	0.35	38.5	2.370	509.84
8	23	0.144	140	0.65	37.7	2.410	946.85

Table 4.4 Experimental results of turning Aluminum with Zinc coated tool

S N .	Diame ter (D)mn	Feed (f) mm/ ev	Spe d (S)r m	Dep h of cut (d)n m	Tempera ture (T)°C	Surfac e rough ess Ra(µm	MRR (mm^3/ min)
1	23	0.080	100	0.35	40	2.31	202.32
2	23	0.080	100	0.65	41	2.652	375.73
3	23	0.080	140	0.35	43	3.752	283.25
4	23	0.080	140	0.65	44	2.912	526.03
5	23	0.144	100	0.35	41	2.392	364.17
6	23	0.144	100	0.65	42	3.01	676.32
7	23	0.144	140	0.35	44.2	1.84	509.84
8	23	0.144	140	0.65	47.3	1.891	946.85

Validation of results:

A graph is drawn between input and output details and analyzed by standard result

4.1.3 Variation of Temperature with input parameters:

The below graphs were plotted for analyzing the relation between chip-tool interface at different temperatures with various parameters like feed rate, dept of cut and speed rate. And comparing graph plotted between coated tool with zinc and nickel and for uncoated tool as shown in graph 4.1, 4.2 & 4.3.

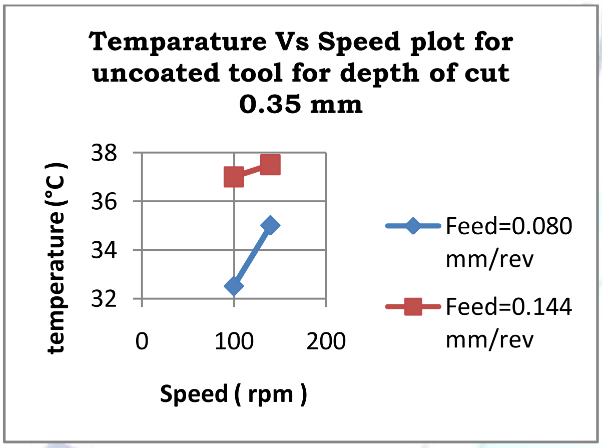

Figure 4.1 Temperature Vs Speed plot for uncoated tools for d=0.35mm

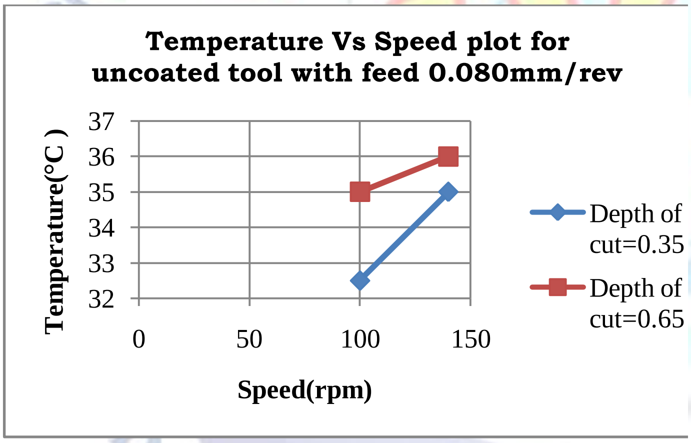

Figure 4.2 Temperature Vs Speed plot for uncoated tool with f=0.080mm/rev

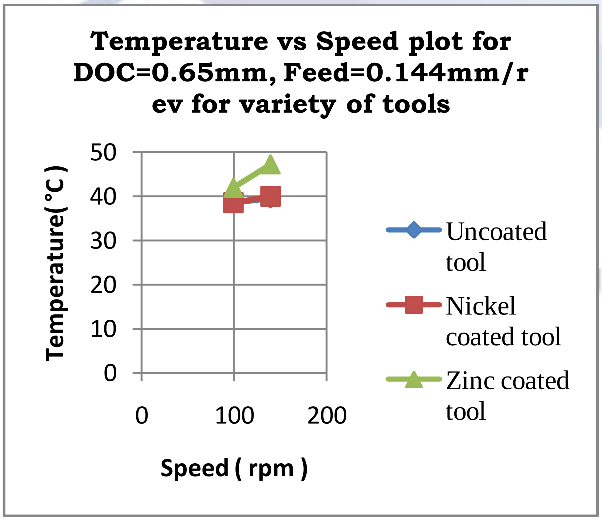

Figure 4.3 Temperature Vs Speed plot for all three kinds of tools with d=0.65mm& f=0.144mm/rev

4.1.4 Variation of Surface Roughness with various input parameter

Following graphs are plotted to compare the relationship between surface roughness of machined work-piece with the input parameter speed rate, feed rate and depth of cut. Moreover comparative plot for surface roughness produced with uncoated tool, tools that are coated with nickel and tool that are coated with zinc is shown in following graph 4.4, 4.5 & 4.6.

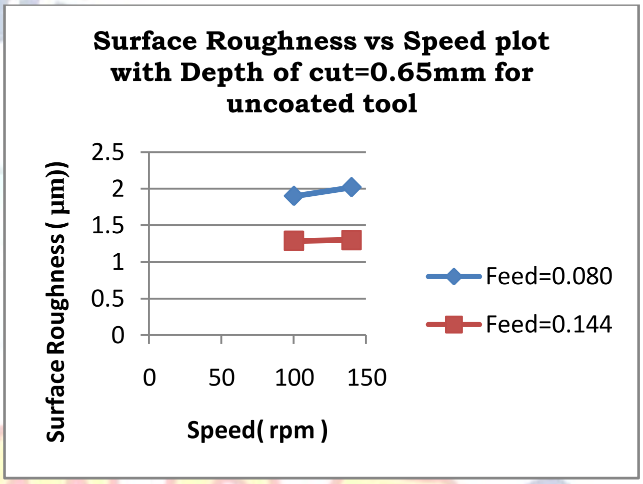

Figure 4.4 Surface Roughness Vs Speed plot for machined surface with uncoated tool with d=0.6mm

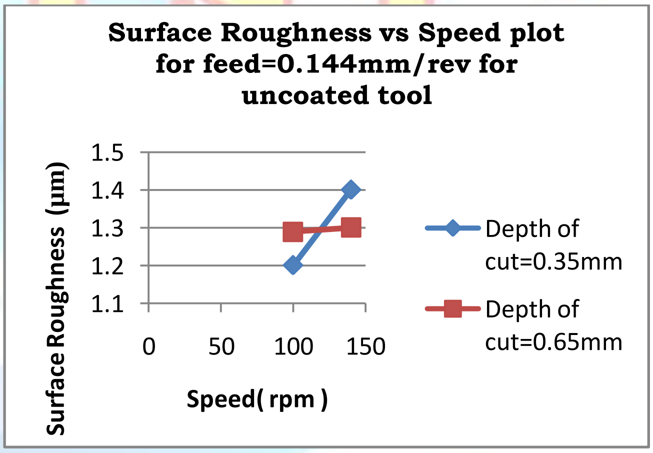

Figure 4.5 Surface Roughness Vs Speed plot for machined surface with uncoated tool for f=0.144mm/rev

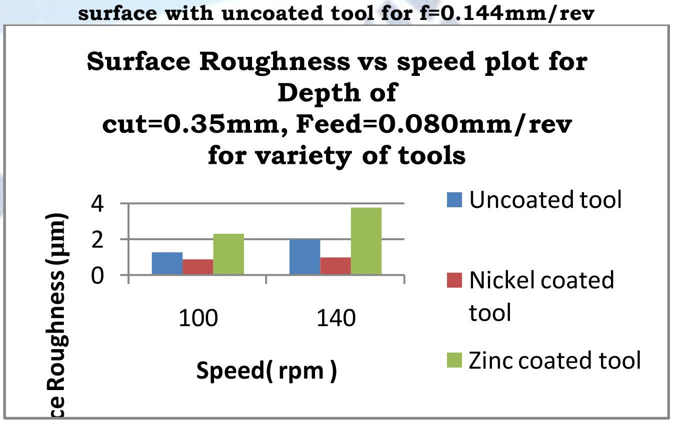

Figure 4.6 Surface roughness vs Speed plot for machined surface with all three variety of tools with d=0.35mm& f=0.080mm/rev

4.2 Machining parameters:

Experimentation 2:

The table 4.5 shows the numerical values for various machining parameters like cutting rate, speed, feed rate and the depth of cut for experimentation.

Table 4.5 Cutting Parameters

Cutting speed N (rpm)	Feed F (mm/rev	Depth of cu d(mm)
328	0.049	0.2
500	0.099	0.5

4.2.1 Experimental Result:

In the following table the experimental result of turning aluminum work-piece with various tools in dry environment is shown.

Table 4.6 Experimental result for turning operation of Aluminum with uncoated tool

S.No	Diameter(D) mm	Feed (f) mm/rev	Speed (S) Rpm	Depth of cut (d)mm	Temperature(T) °C	Surface roughness Ra(µm	MRR (mm³/min)
1	24	0.049	328	0.2	39.4	17.00	242.36
2	24	0.049	328	0.5	40	12.73	605.9
3	24	0.049	500	0.2	41	13.37	369.45
4	24	0.049	500	0.5	42.5	24.62	923.62
5	24	0.099	328	0.2	43	11.32	489.66
6	24	0.099	328	0.5	44.6	8.48	1224.16
7	24	0.099	500	0.2	46	13.36	746.44
8	24	0.099	500	0.5	48.5	15.98	1866.11

Table 4.7 Experimental results of turning Aluminum with Nickel coated tool

S.No	Diameter(D) mm	Feed (f) mm/rev	Speed (S) Rpm	Depth of cut (d)mm	Temperature (T)°C	Surface roughness Ra(µm	MRR (mm³/min)
1	24	0.049	328	0.2	39.8	2.16	242.36
2	24	0.049	328	0.5	44.2	5.12	605.9
3	24	0.049	500	0.2	38.4	3.22	369.45
4	24	0.049	500	0.5	42.6	3.88	923.62
5	24	0.099	328	0.2	41.2	6.59	489.66
6	24	0.099	328	0.5	43	4.47	1224.1
7	24	0.099	500	0.2	42.5	6.33	746.44
8	24	0.099	500	0.5	44.5	4.51	1866.1

Table 4.8 Experimental results of turning Aluminum with Zinc coated tool

S.No	Diameter(D) mm	Feed (f) mm/rev	Speed (S) Rpm	Depth of cut (d) mm	Temperature (T)°C	Surface roughness Ra(µm	MRR (mm³/min)
1	24	0.049	328	0.2	40.4	5.69	242.36
2	24	0.049	328	0.5	42	4.08	605.9
3	24	0.049	500	0.2	38.2	4.28	369.45
4	24	0.049	500	0.5	42.2	8.10	923.62
5	24	0.099	328	0.2	41.8	8.66	489.66
6	24	0.099	328	0.5	44.2	6.92	1224.16
7	24	0.099	500	0.2	43.4	4.95	746.44
8	24	0.099	500	0.5	46.2	9.76	1866.1

4.2.2 Validation of Results:

In reference to verify the result obtained graph is plotted between various input &output parameters and compared with standard result.

4.2.3Variation of Temperature with input parameters:

Following graphs are plotted to compare the relationship between temperature at the chip-tool interface with the input parameter speed, feed and depth of cut. Moreover comparative plot of temperature generated for uncoated tool, tool coated with nickel and tool coated with zinc is shown in following graph of Fig 4.7, 4.8 & 4.9.

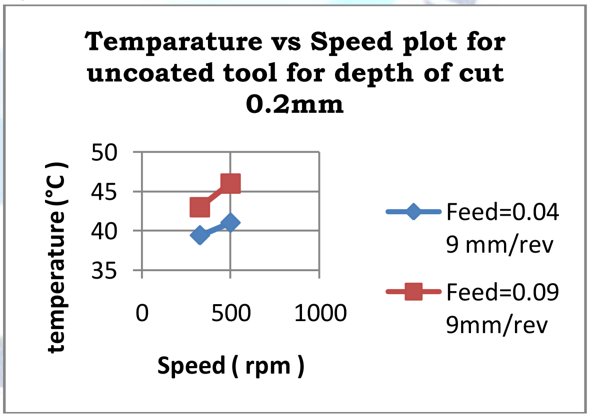

Figure 4.7 Temperature Vs Speed plot for uncoated tool for d=0.2mm

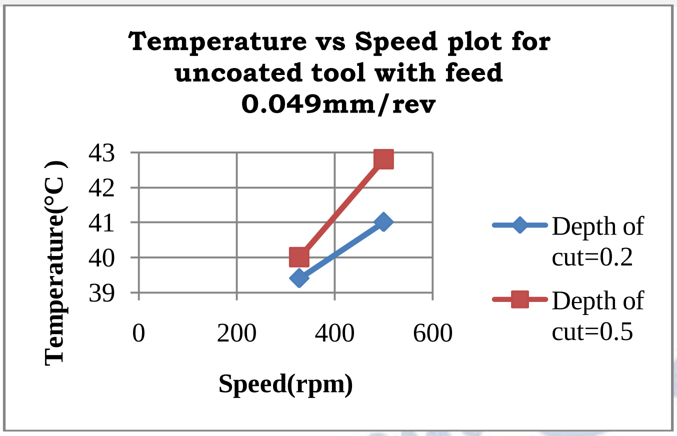

Figure 4.8 Temperature Vs Speed plot for uncoated tool with f=0.049

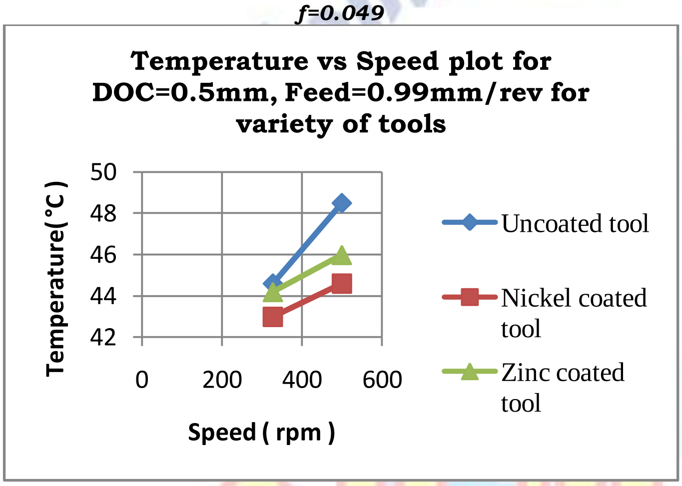

Figure 4.9 Temperature Vs Speed plot for all three types of tool with d=0.5mm& f=0.099mm/rev

4.2.4Variation of Surface Roughness with various input parameter:

Following graphs are plotted to analyze the relationship between surface roughness of machined work-piece with the input parameter speed, feed and depth of cut. Moreover comparative plot of surface roughness produced with uncoated tool, tool coated with nickel and tool coated with zinc is shown in following graphs 4.10, 4.11 & 4.12.

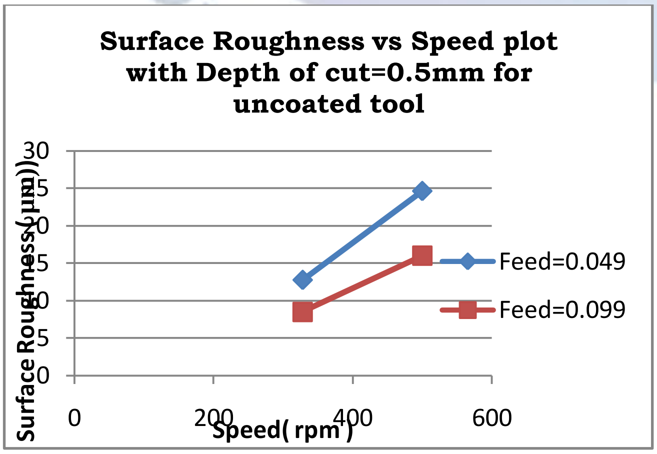

Figure 4.10 Surface Roughness vs Speed plot for machined surface with uncoated tool with d=0.5mm

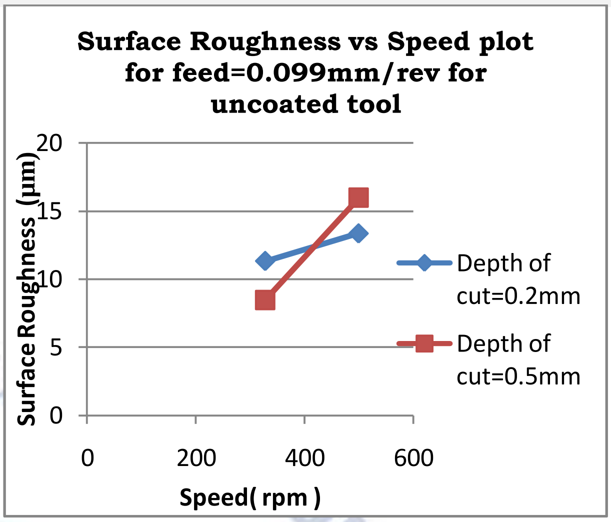

Figure 4.11 Surface Roughness vs Speed plot for machined surface with uncoated tool for f=0.099mm/rev

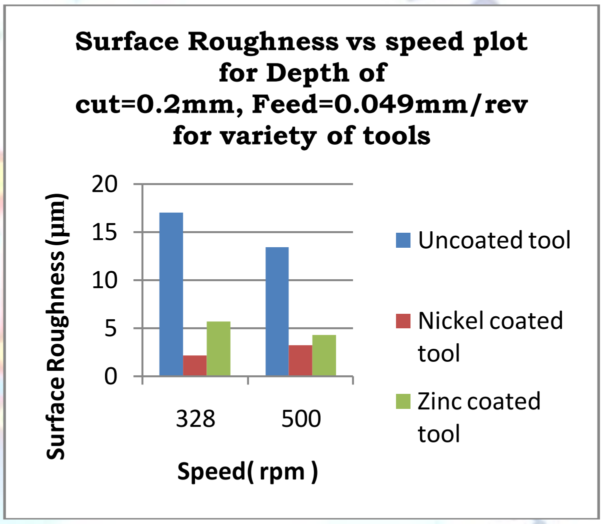

Figure 4.12 Surface roughness Vs Speed plot for machined surface with all three variety of tools with d=0.2mm& f=0.049mm/rev

4.3 Discussion:

4.3.1 Temperature:

During the turning operation high amount of heat energy is produced by shearing and rubbing action. Most extreme measure of warmth is conveyed by streaming chips and some amount passes to work-piece and tool material. For the given set of speed, feed and depth of cut the temperature the maximum temperature observed from exp:1 is 46.7 °C&exp:2 is 48.5°C. However if the values of speed, feed and depth of cut are increased to high level the rise in temperature will be high.

From the plot of temperature with respect to speed, it is clearly seen that with increase in speed the heat generation process increases causing rise in interface temperature. Similarly on increasing the feed value from 0.080mm/rev to 0.0144mm/rev and 0.49mm/rev to mm/rev 0.099 at constant temperature and depth of cut the rise in temperature is observed.

In the similar fashion while increasing depth of cut from 0.35mm to 0.65mm and 0.2mm to 0.5mm keeping the values of speed and feed constant the temperature generated in turning process is increased.

4.3.2 Surface Roughness:

During the experiment the surface roughness value is measured in terms of roughness average (Ra) which is the arithmetic mean deviation of surface profile from mean line.

From the plot of roughness value with speed it is clearly seen that with increase in speed the surface roughness increases. Similarly on increasing the depth of cut from 0.35 mm to 0.65mm& 0.2 to 0.5 in most of the cases surface roughness is increased. But no clear relation was found between the feed value and surface roughness value. May be this is owing to the built-up edge formation on tool during the machining process or due to use of same cutting tool for a long time.

4.3.3 Uncoated tool Vs coated tool:

From the comparative plot of temperature with speed for uncoated tool, tool coated with zinc and tool coated with nickel it is found that temperature generated during machining with zinc coated tool is found greater than during machining with uncoated tool and nickel coated tool.

From the heat generation point of view nickel can be considered as a good material for tool coating while zinc is not considered as good material for coating from this project.

Similarly machining with nickel coated tool produced good surface finish compared to uncoated and zinc coated tool. Zinc coated surface produced comparatively rough surface. So from surface roughness point of view nickel can be considered as a good material as cutting tool coating.

V Conclusion

The experimentation showed that further research can be preceded for metal coating of tool by electroplating method. Measuring the tool-chip interface by using infrared thermometer has been a very fine technology.

The increase in depth of cut, feed and speed increases the temperature of tool chip interface. The obtained during usage of zinc coated tool is high when related to the temperature obtained for nickel coated and uncoated tool. Increasing feed value from 0.08 mm/rev to 0.144 mm/rev and 0.49mm/rev to 0.099 mm/rev at stable temperature and constant depth of cut the temperature is raised.

The increase in depth of cut, speed the surface roughness value is also increased. The surface roughness values are more accurate for the speed of 500 rpm when compared to the speed of 328 rpm. No proper relationship has been obtained between feed speed of tool and surface roughness. Nickel coated has fine surface roughness and of course zinc coated tool gives fine roughness when compared to uncoated. As per experiment and calculation done nickel is considered as better metal coating for cutting tool according to experts of surface finish and heat generation

VI SCOPE OF FEATURE WORK

With increasing demand of high quality product with lesser price the manufacturing industry has be competitive. Machining is the fundamental process for any manufacturing process and companies are always in seek of better technology the scope of study in the performance of machining process is high.

Some of the field of study for future work can be listed as:

1. Research on electroplating coating of cutting tool can be furthered because of its cheapness and ease of technology.
2. Further research can be extended to study the performance of single point cutting tool with variety of metal coating.
3. Study on generation of heat during machining can be studied with the use of infrared thermometer.
4. Since surface finish is a crucial factor for any product manufactured the way to increase surface finish may be a great field of study.
5. Study can be continued on life of cutting tool and it's wear mechanism.
6. Study on nickel coated tool can be furthered because of its good behavior towards heat generation and surface finish.

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