TO STUDY THE EFFECTS ON SURFACE ROUGHNESS AND TOOL LIFE BY USE OF DIFFERENT CUTTING FLUIDS IN TURNING OF SS 305 AND EN8

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Abstract— *Surface roughness and tool wear is major problem in metal cutting and fitting industries in now a day. In turning process, tool wear can create parts that are out-of-size and cause tool failure also. The repetition of machining work that subjects on the tool tip interface to a range of cutting cooling medium to comparatively evaluate their effect on tool life. The efficiency of cutting tools can be finding based on some parameters such as flank wear, surface roughness on the work piece, cutting forces developed and temperature developed at the tool chip interface. The objective of this research work is to determine the effects of types of cooling medium used on tool wear and surface roughness during turning of SS 305 and medium-carbon steel EN8, cold drawn high temperature with Tin Coated HSS tool. By using oil based coolant, water, and air as the coolant on the turning process, the three types of coolant are compared to find the most effective coolant which resulting the less tool wear will be the optimum coolant for the materials using in this research work By comparing the three coolants that is oil, water, and air to determine which one would be the most effective coolant for efficient surface roughness and heat removal from the cutting tool. Then, we will compare the three coolants by using the Mitutoyo surface roughness tester (SJ-210P) which is having a LC of 0.001 µm. The types of coolants will be selected from the metal cutting industries using them rapidly with regard to the performance indexes such as surface roughness and less tool wear on the cutting tool. Finally, the research work concludes with a summary of this study and future scope*

Keywords— Feed Rate; Depth of Cut; Cutting Speed; Flank wear; Coolant; Surface Roughness

1. INTRODUCTION

At presently in most of metal cutting industries the most commonly cutting fluids are employed in machining to reduce friction, cool the work piece, and wash away the chips from work place. With the application of cutting fluids, improve the machined surface quality and reduces the tool wear. Often the cutting fluids also protect the machined surface from corrosion. They also minimize the cutting forces thus saving the energy. These advantages of using cutting fluids in machining are also having a number of disadvantages. Sometimes the cutting fluid costs are more than twice the tool related costs. Most of the cutting fluids possess the health hazard to the operator and the environment. Disposal of the used cutting fluid is also a major issue.

In the recent time, there has been a general liking for dry machining. On the other side, many researchers started exploring the application of minimal cutting fluid. In this thesis, a research on performance evaluation of different types of cutting fluids in the machining of hardened steel material is presented. Cutting fluid (coolant) is any liquid or gas that is applied to the chip and/or cutting tool to improve cutting performance as well as surface finish. A very few metal machining operations are performed in dry environment, i.e., without the application of cutting fluids. Generally, it is essential that cutting fluids be applied to all metal cutting operations like turning slotting etc.

2. OBJECTIVE OF THE WORK

The objectives of the research work are to:

1. To determine the optimum coolant in order to decrease lathe cutting tool wear for metal cutting process.
2. To determine the optimum coolant on surface roughness of work pieces

3. TYPES OF COOLANT USED IN METAL CUTTING

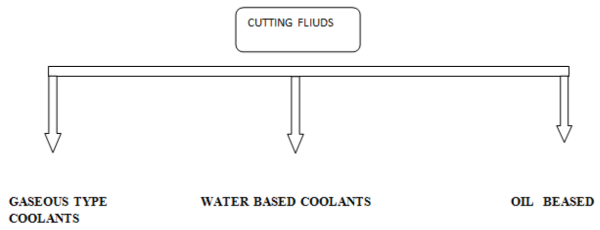


Figure 1.0: Type of cutting fluids

4. DESIRABLE PROPERTIES OF COOLANT

The properties of the cutting fluids is also classified as,

- Performance properties
- Service properties.

Performance properties are those that contribute to reduction in forces, improvement within the tool life, higher surface, and dimensional stability associate degree an economy in production. Service properties of the agent associated with their impact on the machine, work piece and operator and their stability.

The principal service properties their as follows:

1. No impact on the traditional lubrication.
2. No oxidization or corrosion of the machine or work piece.
3. No alternative morbid impact on operator.
4. Easy flushing and detergent action on the machine sump the fluid system.
5. No foaming, fogging or misting.
6. Low cost.
7. Optimum service life.

5. Objectives

The objectives of the project are to:

1. To determine the optimum coolant on surface roughness of work pieces.

2. To determine the optimum coolant in order to decrease lathe cutting tool wear for machining process.

6. Work Terminology Used

To carry out this research work on use of different coolants and find the optimum coolants for different materials to achieve these goals we have to set up installed has following hardware and the equipment's to be used for measurement of different quantities like surface roughness, tool wear, feed rates.

Figure 6.0: lathe machine

Figure 6.1: work piece EN 8 and stainless steel 305

7. Observations

The data is obtained by using the Surface Roughness Tester. By putting the different feed rates and use of different type of cutting, we obtained the data and compare them to get results.

7.1Effect on Surface Roughness (RA) when depth of cut is 0.3 mm

The surface roughness (RA) readings w.r.t. 0.3 mm depth of cut has been noticed as shown in the table 7.1, table 7.2, table and table 7.3

TABLE 7.1: SURFACE ROUGHNESS W.R.T. AIR AS COOLANTS AT 0.3 MM DEPTH OF CUT

Sr no	Materials	Cutting fluid	Depth of cut	Surface Roughness before turning	Feed Rate in (mm/rev.)			
					0.533	*0.266*	*0.134*	*0.066*
1	SS-305	Air	0.3	5.33	4.77	4.25	3.99	3.58
2	EN 8	Air	0.3	7.51	6.46	5.39	4.77	4.09

TABLE 7.2: SURFACE ROUGHNESS W.R.T. WATER AS COOLANTS AT 0.3 MM DEPTH OF CUT

Sr. no	Materials	Cutting fluid	Depth of cut	Surface Roughness before turning	Feed Rate in (mm/rev.)			
					0.533	*0.266*	*0.134*	*0.066*
1	SS-305	Water	0.3	3.58	4.68	4.45	3.70	3.08
2	EN 8	Water	0.3	4.09	7.51	6.47	5.50	5.03

TABLE 7.3: SURFACE ROUGHNESS W.R.T. OIL AS COOLANTS AT 0.3 MM DEPTH OF CUT

Sr. no	Materials	Cutting fluid	Depth of cut	Surface Roughness before turning	Feed Rate in (mm/rev.)			
					0.533	*0.266*	*0.134*	*0.066*
1	SS-305	Oil	0.3	2.88	4.10	3.71	3.00	2.65
2	EN 8	Oil	0.3	5.03	6.46	6.02	5.51	4.69

8. Results and Analysis

It has been observed that cooling medium and cooling conditions have a great effect on surface roughness, finished part size and also on tool life. So that in now a day the parameters and cutting conditions which are studied in this experiment are most important factors in current metal cutting industries.

These experiments were conducted by selecting the different cooling mediums as well as cutting parameters like speed, depth of cut and different feed rates. By comparing the values of surface roughness which are noticed by testing of the all specimens on surface roughness tester we have some results which are shown with help of graphs. In this work we have three different cooling medium and four different feed rates of carriage and some parameters are fixed like spindle speed, depth of cut etc.

Tool Life Calculations:

This relationship is credited to F. W. Taylor (~1900)

$vT^n = C$

Where v = cutting speed; = cutting speed; T = tool life; and = tool life; and n and

C are parameters that depend on feed, depth of cut, work material, tooling material, and the tool life criterion used can be find from machine data hand book.

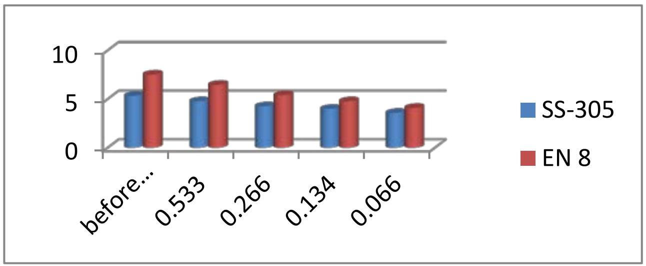
- n is the slope of the plot
- C is the intercept on the speed axis.

8.1 Effect on Surface Roughness (RA) when depth of cut is 0.3 mm

Figure 8.1, 8.2 and 8.3 is indicating the effect of different cutting fluids. It was found that maximum surface finish is achieved when depth of cut is 0.3 mm and lubrication oil used as coolant on SS 305 at 0.066 mm/rev. It was also noticed that there is slow improvement in SS 305 by using air as coolant as well as in EN 8

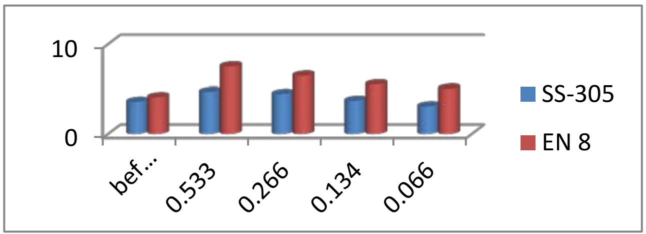
We can also find from all graphs that there is rapid improvement in surface roughness from 0.266 to 0.134 mm/rev. due to slow feed rate occurring. And we can also see that there in rapid decrement in surface roughness at 0.553 mm/rev. and before turning condition it is also due to rapid change in feed rate (fast feed rate) and we know that surface roughness is inversely proportional to the feed rate means slow feed gives better surface roughness as compare to the fast.

It was also find that the least value of surface roughness is found in case when we take depth of cut is 0.3 mm.



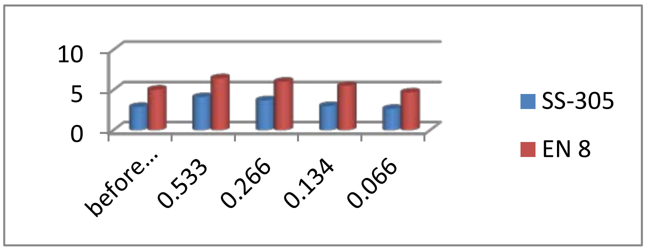
Feed Rate in (mm/rev.)

Figure 8.1: Shows the effect of air as cooling medium on surface roughness with 0.3 mm depth of cut



Feed Rate in (mm/rev.)

Figure 8.2: Shows the effect of water as cooling medium on surface roughness with 0.3 mm depth of cut



Feed Rate in (mm/rev.)

Figure 8.3: Shows the effect of oil as cooling medium on surface roughness with 0.3 mm depth of cut

9. CONCLUSIONS

This research work is done to find the optimum and correct cutting conditions and correct cooling medium for given engineering materials which are mostly used in now a day in metal cutting industries for their surface roughness properties, applying different type of coolants like water, air and lubricating oil with different feed rates.

- ➢ It is found that in this research lubricating oil have a great effect on outputs (surface roughness) considered in the present study as compare ton other coolants
- ➢ From these studies it was found that least value of surface roughness is found in case when we take depth of cut is 0.3 mm.
- ➢ We can also find from all graphs that there is rapid improvement in surface roughness from 0.266 to 0.134 mm/rev. in 0.5 mm cut due to slow feed rate occurring but it is more as compare to the last results (0.3 mm depth of cut).
- ➢ We can also see that there in rapid decrement in surface roughness with water at 0.553 mm/rev. and before turning condition it is also due to rapid change in feed rate.

10. FUTURE SCOPE OF PROJECT

In order to achieve the objectives of this research work, the scopes are list as below:

➢ Analysis and Evaluate the surface roughness by using the surface roughness tester (SJ-210P) to measure the surface roughness after machining using different types of coolants.

➢ Usage of optimum types of the coolants such as oil based coolant, water as a coolant, and air on lathe machining in hard and soft turning operation on other engineering materials.

➢ For the turning process, the constant parameter such as work pieces use is SS 305 and medium-carbon steel EN8, depth of cut (0.3, 0.5mm and 0.7mm), tool material Tin Coated HSS bar; feed rate (f = 0.533,0.266,0.134,0.066 mm/rev. but parameter is not fixed that is types of coolant use are oil, water and air.

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