

ANALYSIS OF TOOL WEAR DURING DRY AND WET TURNING RESEARCH METHODOLOGY

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ABSTRACT

This thesis was proposed to study and analyze the surface properties of mild steel and tool life during dry, water, oil and mixture of oil and water cooling during turning on the lathe. The tool life and surface properties (surface roughness) of mild steel during turning with mixture of oil and water cooling found very good. In this process order to tackle a multi-objective optimization problem which seeks identification of the best process condition or parametric combination for the manufacturing processes, dry and wet turning, In the present experiment investigation on straight turning of mild-steel bar by using HSS tool. This experiment has aimed to evaluate best manufacturing process which could satisfy both productivity as well as quality with special focus on reduction of cutting tool wear. Because reduction in tool wear ensures increase in tool life. The experimental analysis showed that surface properties of mild steel improved when

wet turning (mixture of oil and water) was carried out.

1. INTRODUCTION

Productivity and quality of machined parts are the main challenges of metal cutting industries. Turning is mostly used process among all the machining processes. The growing demands for high productivity and quality of turned parts in terms of surface finish and less time for machining need use of high cutting velocity [22]. Manufacturing industries faces problems of dimensional inaccuracy, short tool life & surface quality problem during machining. There are several techniques which are used to improve surface quality & protect tool life by use of coolant or cutting fluid. Cutting fluids are used for improving surface finish & tool life [1]. All machining process depends on cutting tool. All demands in production like workpiece quality, dimensional accuracy & surface roughness mainly depends on cutting and coolant [12]. Among all

steels Mild steel have special place in the manufacturing sector because of its mechanical properties like machinability, less cost and Ductility. Therefore it is mostly used as raw material in all the machining process [8]. During turning operation material removed from work piece in the form of chips by the shear action of cutting tool. Heat generated due to rubbing of tool on work piece as well as shear action. Generated heat will distribute on work piece, tool and chip. This heat affects cutting process. So Temperature generated in cutting tool-chip interface is taken as one of the parameter to analyze the performance [2]. As depth of cut increases it increase cutting temperature as well as surface roughness and causes more tool wear [4].

2 METHODOLOGY

2.1 OBJECTIVE OF PRESENT WORK

The purpose of this research is to investigate the surface roughness in turning operation under different cooling conditions and at the same time calculating the weight of single point cutting tool by the high precision digital balance meter

before and after machining. The material losses of single point cutting tool at different cooling conditions are nothing but the tool wear of the cutting tool as it loses its weight during operation.

2.2 MATERIAL SELECTION

2.2.1 Mild Steel

Mild Steel is a type of steel that contains only a small amount of carbon and other elements. It is softer and can be shaped more easily than higher carbon steels. It also bends a long way instead of breaking because it is ductile. It is used in nails and some types of wire; it can be used to make bottle openers, chairs, staplers, staples, railings and most common metal products. Its name comes from the fact it only has less carbon than steel. The proportions of manganese (1.65%), copper (0.6%) and silicon (0.6%) are approximately fixed, while the proportions of cobalt, chromium, niobium, molybdenum, titanium, nickel, tungsten, vanadium and zirconium are not fixed. A higher amount of carbon makes steels different from low carbon mild-type steels. A greater amount of carbon makes steel stronger, harder and very slightly stiffer than low carbon steel. However, the strength and hardness comes at the price of a decrease in the ductility of this alloy. Carbon atoms get trapped in the interstitial sites of the iron lattice and make it

stronger. The calculated average industry grade mild steel density is 7.85 gm/cm³. Its Young's modulus, which is a measure of its stiffness, is around 210 GPa. Mild steel is the cheapest and most versatile form of steel and serves every application which requires a bulk amount of steel. Mild steel has a maximum limit of 0.2% carbon. The low amount of alloying elements also makes mild steel vulnerable to rust. Naturally, people prefer stainless steel over mild steel, when they want a rust free material. Mild steel is also used in construction as structural steel. It is also widely used in the car manufacturing industry. Mild steel is used in almost all forms of industrial applications and industrial manufacturing [19].

2.2.1.1 Specification of specimen:

- Percentage of Carbon = 0.05 – 0.15 %
- Density = 7.85 g/cm³
- Young’s Modulus = 210 GPa

2.2.1.2 Parameters of specimen:

Table 2.1 Parameters of specimen

Length of specimen	100 mm
Initial Diameter of specimen	40 mm
Diameter after machining	38 mm
Depth of cut	2 mm

2.2.2 Cutting Tool (High Speed Steel)

The term high speed steel was derived from the fact that it is capable of cutting metal at a much higher rate than carbon tool steel and continues to cut and retain its hardness even when the point of the tool is heated to a low red temperature. Tungsten is the major alloying element but it is also combined with molybdenum, vanadium and cobalt in varying amounts. Although replaced by cemented carbides for many applications it is still widely used for the manufacture of taps, dies, twist drills, reamers, saw blades and other cutting tools. In this paper mild steel is used as work piece and tool is a single point cutting tool made up of high speed steel and the turning operation is performed on a lathe machine having different lathe speed taken into account [19]. For this experiment we have used MIRANIDA S-400 tool (9.53*76.20 mm).



Fig 3.1 HSS Single Point Cutting Tool

2.3 EXPERIMENTAL PROCEDURE

Turning operation performed on lathe machine using mild steel as a work piece and high speed steel as cutting tool.

- Preparation of workpiece
- Turning is done at constant depth of cut, feed rate and cutting speed and varying cooling conditions.
- Surface roughness will Measure by Dial gauge.
- Calculates the weight of single point cutting tool by the high precision digital balance meter before and after turning
- Calculates the weight of workpiec by the high precision digital balance meter before and after turning.
- Results are evaluated after the plotting different graphs.
- Measuring chip thickness using vernier caliper.

3 RESULTS AND DISCUSSION

3.1 MATERIAL LOSS OF SINGLE POINT CUTTING TOOL AT DIFFERENT CUTTING PARAMETERS

According to table 4.1 Material Loss Of Single Point Cutting Tool At Different Cutting Parameters shows that maximum material remove from cutting tool in dry turning which is .026. It indicates

that maximum tool life is in case of turning with mixture of oil and water cooling because in this turning process tool wear is less among all which is .001.

Table 3.1 Material Loss Of Single Point Cutting Tool At Different Cutting Parameters

S. No	Dry	Water	Oil	Mixture of oil and water cooling
1	.026	.004	.002	.001

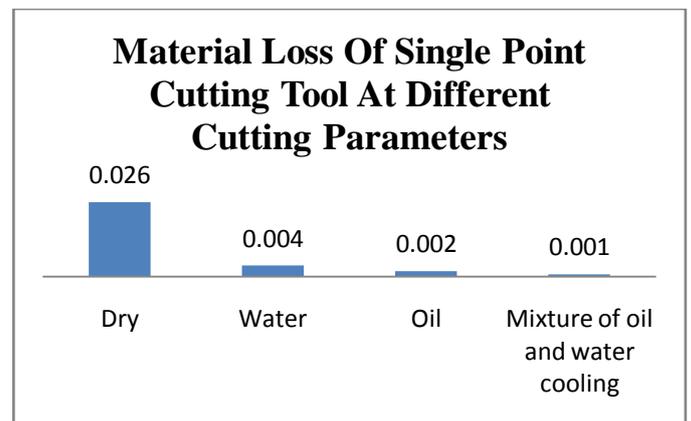


Fig 3.1 Material Loss Of Single Point Cutting Tool At Different Cutting Parameters

3.2 ANALYSIS OF SURFACE ROUGHNESS

These values (table 3.7) are taken from dial gauge (Aerospace made, 0-10 mm, .01 mm). In this experiment we found total 70 mm length by turning operation. The initial diameter of work piece is 38 mm and final diameter that we obtain from analysis is 30 mm. From this 70 mm length we take reading at every 2 mm

distance with the help of dial gauge. To determine average surface roughness we use centre line average method.

Table 3.2 Average Surface Roughness Value For Different Cooling Parameter

S. No.	Dry	Water	Oil	Mixture Of Oil And Water Cooling
1	0.021142857	0.062	0.015714286	0.012857143

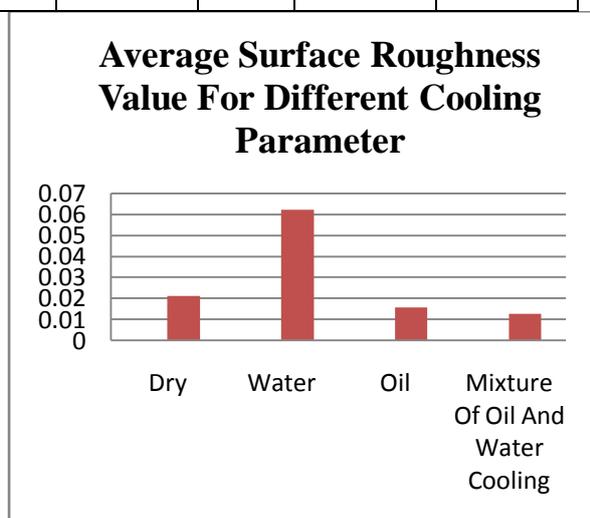


Fig 3.2 Average Surface Roughness Value For Different Cooling Parameter

From table 3.2 we got lowest average surface roughness value of turning with mixture of oil and water cooling which shows higher surface finish.

CONCLUSION

This thesis was proposed to study and analyze the surface properties of mild steel and tool life during dry, water, oil and

mixture of oil and water cooling during turning on the lathe. The tool life and surface properties (surface roughness) of mild steel during turning with mixture of oil and water cooling found very good. The following conclusions could be made on the basis of experiment this work provides us information about the effect of cooling on surface finish and tool life. Various cutting parameters like speed, feed rate and depth of cut are constant for every experiment. The selection of cutting fluids (mixture of oil and water) for turning processes generally provides various benefits such as longer tool life, higher surface finish quality and better dimensional accuracy.

REFERENCES

1. S. Sulaiman et al. (2015), "Influence of Dry Machining Parameters in Minimization of Tool Wear", 3rd International Conference on Advances in Engineering Sciences & Applied Mathematics.
2. Shreedhar bhattacharai (2015), "Performance analysis of coated single point cutting tool in turning operation", international journal of innovative technology and research, vol-3, 2234 – 2243.
3. Ravi Butola et al. (2017), "Effect on Surface Properties OF Mild Steel During Dry Turning & Wet Turning

- On Lathe", *Materials Today: Proceedings*, 7892–7902
4. P. Sivaiah et al. (2018),"Effect of cryogenic coolant on turning performance characteristics during machining of 17-4 PH stainless steel: A comparison with MQL, wet, dry machining", *CIRP Journal of Manufacturing Science and Technology*.
 5. O. Cakir et al. (2004),"Comparison of gases applications to wet and dry cuttings in turning", *Journal of Materials Processing Technology*, 35–41.
 6. S. Schindler et al. (2014),"Finite element model to calculate the thermal expansions of the tool and the workpiece in dry turning",6th CIRP International Conference on High Performance Cutting, HPC2014,Procedia CIRP 14 ,535 – 540.
 7. Yacov sahijpaul et al. (2013),"Determining the Influence of Various Cutting Parameters on Surface Roughness during Wet CNC Turning Of AISI 1040 Medium Carbon Steel", *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, Vol-7,63-72
 8. Mohd. Sibghatullah et al. (2015),"To Study The Surface Roughness And Chip Thickness During Machining Of Mild Steel (Aisi-1008) Using Vegetable Based Oil As A Cutting Fluid", *International Journal of Science, Engineering and Technology Research (IJSETR)*, Vol-4.
 9. Osarenmwinda et al.(2014),"Effect of Cutting Fluids on the Flank Wear of High Speed and Carbide Tipped Cutting Tools", *Effect of Cutting Fluids on the Flank Wear of High Speed and Carbide Tipped Cutting tools*,Vol-18, 159-163.
 10. K.G Sathisha et al. (2016),"Effects of Cutting Fluids and Machining Parameter on Turning of Mild Steel", *National Conference on Advances in Mechanical Engineering Science*, 406-410
 11. S.S. Acharya et al. (2015),"Experimental Investigation of Turning Process in Wet and MQL system on EN 31 Alloy Steel", *International Journal of Scientific & Engineering Research*, Vol-6, 1074-1080.
 12. R. Serra et al. (2016),"Experimental Evaluation of Flank Wear in Dry Turning from Accelerometer Data", *International Journal of Acoustics and Vibration*, Vol-21, 50-58.
 13. Sanjivane P. Patil et al. (2016),"Analysis of Tool Life during Turning of En8 in Dry, Wet and MQL Environment – A Review",

- International Journal for Research in Applied Science & Engineering Technology, Vol-4, 29-35.
14. Mohamed Handawi Saad Elmunafi et al. (2015),"Tool Life of Coated Carbide Cutting Tool when Turning Hardened Stainless Steel under Minimum Quantity Lubricant using Castor Oil", 2nd International Materials, Industrial, and Manufacturing Engineering Conference, MIMEC2015, 4-6 February 2015, Bali Indonesia, *Procedia Manufacturing*, 563 – 567.
 15. Janos Kundrak et al. (2013),"Use Of Coolants and Lubricants In Hard Machining", *Technical Gazette* 20, 1081-1086.
 16. Harsh Vardhan Verma et al. (2017),"Experimentation of Surface Roughness of AISI-1080 in Turning Operation under Different Cooling Conditions ", *International Journal of Scientific and Research Publications*, Vol-7, 630-633.
 17. Devanand R. Tayade et al. (2014),"Evaluation of cutting and geometric parameter of single point cutting tool for turning operation", *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*, Vol-1, 167-171.
 18. Pei Yan et al. (2015),"The effect of cutting fluids applied in metal cutting process", *Journal of Engineering Manufacture*, 1-19.
 19. Zeenat Fatima et al. (2013),"Effects Of Three Different Cutting Fluids In The Turning Of Mild Steel Aisi1008",*International Journal of Technical Research and Applications*, Vol-1, 19-22
 20. J. Braz. Soc. Mech. (2001), "Application of Cutting Fluids in Machining Processes", *Journal of the Brazilian Society of Mechanical Sciences*, VOL-23.
 21. E. Kuram et al.(2010),"Effects of the Cutting Fluid Types and Cutting Parameters on Surface Roughness and Thrust Force", *Proceedings of the World Congress on Engineering*, Vol-2.
 22. Arif Pathan et al. (2015),"Experimental Investigation On Effect Of Cutting Parameters On Surface Roughness And Machining Time In Turning En31 Hardened Steel Under Flooded And Mql Conditions", *International Journal of Modern Trends in Engineering and Research*, vol-2.
 23. Onyemachi Joachim Onuoha et al. (2016),"Determining the Effect of Cutting Fluids on Surface Roughness in Turning AISI 1330 Alloy Steel Using Taguchi Method", *Modern Mechanical Engineering*, 51-59.

24. Rushikesh Waydande et al.
(2016), "Performance Evaluation Of
Different Types Of Cutting Fluids In
The Machining Of Hardened Steel – A
Review", *International Journal of
Mechanical And Production
Engineering*, vol-4, 34-39.