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A Review: MQL System for Taper Turning Operation on CNC Lathe Machine

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Abstract: In present study it has been surveyed that, metal cutting fluid changes the performance of machining operations because of their lubrication, cooling and chip flushing functions. The metal industries using the cutting fluid has become more problematic in nature and working employee health. But the use of cutting fluid machining operations of metal became easier to maintain the work piece surface properties without damages. To reduce the use of cutting fluid in machining operation minimum quantity lubrication (MQL) is used. The growing demands for high productivity of machining need use of high cutting speed and feed rate. Such machining inherently produces high cutting temperature, which not only reduces tool life but also impairs the product quality. Hence some alternatives has been sought to minimize or even avoid the use of cutting fluid in machining operations. MQL is able to reduce the heat which is generated in tool work piece interface.

Keywords: Minimum Quantity Lubrication (MQL), Taguchi method, Taper Turning

1. Introduction

To manufacture any product there must removal of material from it by apply many processes like drilling, boring, turning, etc. In machining process large amount of heat is generated between contact of tool and work piece interface. It effects on product quality and early failure of cutting tool. Metal cutting fluid changes their performance of machining operation because their lubrication is cooling and chip flushing. Cutting fluid acts as a coolant as well as lubricant and also helps in removal of chips. Machining is manufacturing process that involves removing material using cutting tool for getting rid of the unwanted materials from some work piece, but the cutting fluid is more problematic in the operator's health and environmental pollution. But the cooling effect of cutting fluid is considered as a very important parameter. In high speed cutting the large fluctuation of cutting temperature could cause thermal cracks on the cutting edge which leads to failure of cutting tool. By using suitable fluids temperature function are minimized. And it will also improve the dimensional accuracy of machined work piece. The cutting fluid is selected by the type of machining process, types of work material, and types of cutting tool material. It is still essential to obtain an economical tool life and required surface integrities. It is applicable in narrow tolerances, high dimensional accuracies are required or if hard metals are to be machined. It is estimated that the cost of cutting fluids is in the range of 7%-17% of the total costs in the industry.

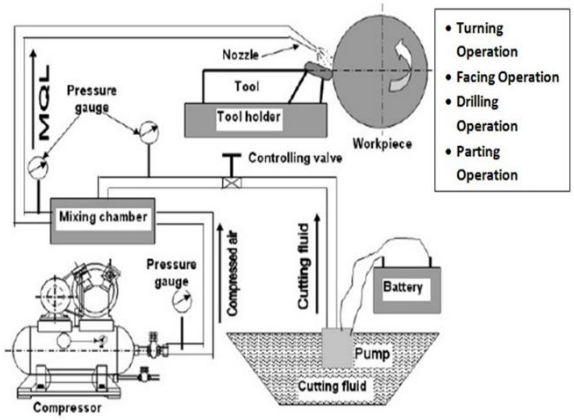
Minimum Quantity Lubrication

To reducing the use of cutting fluid minimum quantity lubrication (MQL) system is used. MQL uses very small quantity of fluids atomized in an air flow towards the cutting zone to reduce the friction between cutting tool and work piece. This is the best suited technique for cutting process. The concept of minimum quantity lubrication (MQL) is delivering a very small amount of coolant to the chip-tool interface in the form of an oil mist or aerosol, as opposed to traditional techniques of flooding the work piece and tool with a substantial volume of liquid coolant. Minimum Quantity lubrication is also known as semi-dry lubrication or micro lubrication. The concept of MQL suggests usage small amount of cutting fluid in the range of 50-300 ml per hour as compared to flood cooling which consumes 5 to 50 liters of cutting fluid per hour.

2. Methodology

In minimum quantity lubrication (MQL) uses small amount of lubricating oil atomized in an air flow towards the cutting zone to reduce the friction between cutting tool and work piece. During the taper turning operation high quantity of heat generated between tool and work piece interface, so it damages the tool in early stage. To decrease the heat of the interface small quantity of cutting fluid is used by the MQL system. It strikes

to the tool and work piece interface. In that taper turning operation the tool cuts the work piece in small



dimension, to reducing the diameter and create taper in the work piece. We give the feed of the tool to cut the work piece.

This operation is performed in following three conditions:-

- Dry cutting
- Flood cutting
- MQL cutting

With consideration of following input parameters:-

- Cutting Speed
- Depth of Cut
- Feed

Checking the following parameters in tool:-

- Temperature
- Surface roughness
- Tool wear
- Chip formation

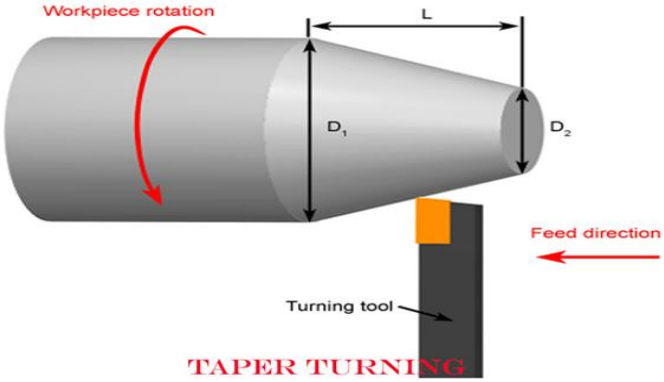
3. Process plan

Process plan for perform experiment on taper turning operation in MQL system as follows:

1) Selection of material
2) Finding Composition of material
3) Design of Experiments by Taguchi Technique
4) Performing taper turning operation in Dry, Flood & MQL condition on CNC Lathe
5) Determine temperature & surface roughness in cutting condition

Taper turning:-

Taper turning is removal of metal on outer diameter of work piece by providing the depth of cut, feed. It creates cone shape gradually decrease in diameter. Work piece have different diameters. When the diameter of a piece changes uniformly, from one end to the other, the piece is said to be tapered. Taper turning as a machining operation is the gradual reduction in diameter from one part of a cylindrical work piece to another part.



4. Taguchi method

Taguchi method are statical method or sometimes it also known as robust design method developed by Genichi Taguchi to improve of quality manufacturing goods and more recently also applied to engineering, biotechnology, marketing and advertising. The taguchi method is based on orthogonal arrays to minimize the number of experiments and to effectively improve product quality.

Steps

1. Selection of design parameters.
2. No. of levels of design parameters.
3. Conduction of experiments based on arrangement of orthogonal arrays.
4. Analysis of result using S/N ratios.
5. Selection of optimal level of design parameter.
6. Verification through conformation experiment

5. Conclusion

Since the purpose of this study is to optimize value of temperature of tool and work piece interface, to minimize the surface roughness, tool wear & type of chip formation. In this experimental study will generate a significant amount of mist compared to flood cooling. With these technologies in place however, machining is safe for both operators and the environment, particularly when mist coolants are used.

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