Analysis the Contribution and Effect of Coolant to Surface Roughness in Cylindrical Grinding

This report submitted in accordance with the requirements of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Process) with Honours

by

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ABSTRACT

This research represents about Analysis the Contribution and Effect of Coolant to Surface Roughness in Cylindrical Grinding. This process is done on the Universal Cylindrical Grinder OD-820H in Manufacturing Laboratory in Universiti Teknikal Malaysia Melaka. Experiment is conducted using a Stainless Steel SUS 304 as a work piece material with dimension of 28mm x 100mm. There are use same coolant with 3 different brix concentrtion. The coolant used in this research is Pretech Cool SYN 3000 Green. The parameters that involve in this research are work head speed, depth of cut, and traverse speed. All other parameters are constant such as coolant which is Pretech Cool SYN 3000 Green with 3%, 6% and 9% Brix concentration. Profilometer of Surface roughness Tester Mitutoyo SJ-301 will be used to measure and identify the surface roughness and it values. This will determine the surface roughness of the material after completing the grinding operations. The factors that influence the surface roughness is will be identified after the material have been machined. Interpretation of result will used for further reference for checking suitable condition parameter on various conditions of operations.
DEDICATION

For my beloved parent, my family best friend and all friends, and to those who’s with me all this time
Alhamdulillah, Thank to Allah the Almighty God for giving me strength and patience to work on this Final Year Project Report.

I would like to take this opportunity to express my sincere and deepest gratitude to my Project Supervisor; Mr. Mohd Amri Bin Sulaiman, for his guidance and opinion in the cause of completing this report.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

FKP - Fakulti Kejuruteraan Pembuatan
Mn - Manganese
Ni - Nickel
PSM - Projek Sarjana Muda
R - Radius
RPM - Revolution per Minute
S - Sulphur
Si - Silicon
Syn - Synthetic
UTeM - Universiti Teknikal Malaysia Melaka
In - Inch
In/min - Inch per Minute
Mm - Millimeter
µm - Micron Meter
µ - Micro
% - percent
CHAPTER 1
INTRODUCTION

1.1 Background of Project

Cutting processes are among the most important of manufacturing operation. They are often necessary in order to impart the desired surface finish and dimensional accuracy to component, particularly those with complex shape that cannot be produced economically or properly by other techniques.

A large number of variables have significant influence on the mechanics of chip formation in cutting operations. Commonly observed chip types are continuous, built-up edge, discontinuous and segmented. Among important process variables are tool shape and material, cutting conditions such as speed, feed, and depth of cut, use of cutting fluids, and the characteristics of the machine tool, work holding device, fixturing, as well as the characteristics of the work piece material, parameters influenced by these variables are force and power consumption, tool wear, surface finish and integrity, temperature, and dimensional accuracy of the work piece. Mach inability of materials depends not only on their intrinsic properties, but also on proper selection and control of process variables.

The distinction between a finishing operation and other processes that affect the surface is that finishing processes are not intended significantly change the dimension of a part (William O. Fellers, 2001). Rather, this finishing operation is intended to achieve closer tolerances and provide protective coating. It is also able to improve the appearance of the part.
Surface finish is specified by giving the desired waviness, roughness, and lay of the desired surface. Waviness refers to the long-range undulations in the surface, not necessarily those left by the tool marks. Roughness refers to the finely spaced textured irregularities. Roughness is usually determined by the tool marks of the final operation.

The quality of machined surface is characterized by the accuracy of its manufacture with respect to the dimensions specified by the designer. Every machining operation leaves characteristic evidence on the machined surface. This evidence in the form of finely spaced micro irregularities left by the cutting tool. Each type of cutting tool leaves its own individual pattern which therefore can be identified. This pattern is known as surface finish or surface roughness.

Grinding is a machining process that employs an abrasive grinding wheel rotating at high speed to remove material from a softer material. In modern industry, grinding technology is highly developed according to particular product and process requirements. Modern machine tools may be inexpensive machines with a simple reciprocating table, or they may be expensive machines. Many grinding machines combine computer-controlled feed-drives and slide-way motions, allowing complex shapes to be manufactured free from manual intervention. Modern systems will usually incorporate algorithms to compensate for wheel and dressing tool wear processes. Programmable controls may also allow fast push-button set-up. Monitoring sensors and intelligent control introduce the potential for a degree of self-optimization (Gwidon Stachowiak, 2004).
1.2 Problem Statement

For the previous student only study about the surface roughness measurement and effect that involved from the surface roughness. The previous study state the coolant is the one of the effect that involved in surface roughness result. So for this study, student have to study about the effect of coolant to the surface roughness. Also, student will study about the concentration factor contribute on surface machining. The type coolant that will be used is Pretech Cool Syn 3000 Green. The material that used in this research is Stainless Steel SUS304. The content of coolant will be adding some water to get the maximum brix concentration. All other parameters are constant such as coolant which is Pretech Cool SYN 3000 Green with 3, 6 and 9 brix concentration. Also the result from the study can be used for guideline the industry that use high precision coolant.

1.3 Objectives

(a) To analyzed the contribution and effect the coolant to surface roughness texture on Stainless Steel SUS304.
(b) To analyzed the surface roughness factor of the finish product using Profilometer Surface Roughness Tester Mitutoyo SJ-301 at the University Metrology Laboratory.
(c) To study the effect use different types of coolant brix concentration
(d) To make comparison between 3 types of coolant on surface roughness value from analysis result.
1.4 Scope of Project

This project is about studying the effect of different brix concentration of coolant on surface roughness by using the cylindrical grinding machine. This process is done on the Universal Cylindrical Grinder OD-820H in Manufacturing Laboratory in Universiti Teknikal Malaysia Melaka. There are uses of coolant with 3 different brix concentrations. The coolant used in this research is Pretech Cool SYN 3000 Green.

The parameters that involve in this research are work head speed, depth of cut and traverse speed. Profilometer of Surface roughness Tester Mitutoyo SJ-301 will be used to measure and identify the contact of surface. This will determine the surface roughness of the material after completing the grinding operations. The factors that influence the surface roughness will be identified after the material have been machined. The material dimension is 28mm for the diameter and 100mm for the length.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Machine tools and cutting tools have advanced in great developments in the past few years. In the past few years ago, machining is a difficult task to be performed but now this task has become common place and have been simplified with more advanced technology that have been involved. Machining, the broad term used to describe removal of material from a work piece (Serope Kalpakjian, Steven R. Schmid, 2001).

Each process should be studied in order to understand the interrelationships of design parameters, such as dimensional accuracy, surface finish and integrity, and process parameters such as speed, feed, depth of cut, tool material and shape, and cutting fluids.

A variety of abrasive processes and machinery are available for surface, external, and internal grinding. The selection of abrasives and process variable in these operations must be controlled in order to obtain the desired surface and dimensional accuracy. Otherwise, damage to surfaces such as burning, heat checking, and harmful residual stresses may develop. Several finishing operations are available for debarring. Because contribute significantly to product cost, proper selection and implementation of finishing operations are important.
In written of (William O. Fellers, 2001), the result to breaking and cutting a piece of material depends on several factors:

(a) The properties of the material being cut.
(b) The properties of the cutting tool.
(c) The speed at which the material is cut.

Those factor giving then the result on the work piece such as geometric shape, dimension, appearance, and also surface integrity. Thus some parts that have been producing in machining would to have other finishing operations, such as grinding. This operation is important to obtain the desire final dimension and surface finish (Serope Kalpakjian, Steven R. Schmid, 2001).

In the grinding process, because of the undefined geometrical cutting edges, there is a large amount of heat caused by different mechanism of shear, friction and separation, which is only partially dissipated by the chips and the rest can lead to a considerable thermal strain and burning on the workpiece and also on the tools. The reduction of heat build-up and proper cooling during grinding are therefore of immense importance (Tawakoli T. et al, 2006).

2.2 Cylindrical Grinding Machine

Cylindrical grinding machine is one of the new machines that arrive in Manufacturing Laboratory in Universiti Teknikal Malaysia Melaka. The cylindrical grinding is used widely in engineering workshop to improve the surface finish of pre-machine and heat-treated components. The machine is able to produce a precise and an accurate dimension of the product with low cost method than others.

The machine that use in Machine Shop Laboratory is Universal Cylindrical Grinder Model S OD 820H with variable speed table and full CNC wheel head in feed manufactured by SHARP Precision Machine Tools. The machine has the capability to machine both of internal and external cylindrical grinding.
Cylindrical grinding machines resemble lathes since they are equipped with a headstock. Tailstock, table, and wheel head. The work piece is held either between centers or securely in a fixture mounted on the work head spindle. There two general classes of cylindrical grinding machine:

(a) Plain
(b) Universal

The general construction of a universal grinder is similar to that plain grinder of the same make, but it differs from the latter in having certain special features and auxiliary attachments. In more advanced of universal grinder the wheel can slide can be swivelled with relation to the travel of the table (Franklin D. Jones, 1964).

In universal grinder, both the work piece and the wheel axes can be moved and swivelled around a horizontal plane, permitting the grinding tapers and other shapes (Serope Kalpakjian, Steven R. Schmid, 2001). Centerless grinder are similar to cylindrical grinder but without centers. The work is supported on a fixed blade under pressure applied by the regulating wheel.

Recent cylindrical grinding machine can use in both operation either centerless-grinding or between-center grinding. Like machine produced by Studer Mikrosa BWF Kronos Series, the Kronos L dual which offers an innovative design which permits the combination of two processes; centerless grinding and grinding between