Faculty of Mechanical and Manufacturing Engineering Technology

THE STUDY OF FLANK USING UNCOATED BORON STEEL (22MnB5) ON ALUMINIUM (AA6061)

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THE STUDY OF FLANK USING UNCOATED BORON STEEL (22MnB5) ON ALUMINIUM (AA6061)

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This report is submitted in accordance with the requirement of the University Teknikal Malaysia Melaka(UteM) for the Bachelor Of Manufacturing Engineering Technology (Process & Technology) with Honours

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DECLARATION

I declare that this thesis entitled “The Study of Flank Wear using Uncoated Boron Steel (22MnB5) on Aluminium (AA6061)” is the results of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have read this thesis and in my opinion, this thesis is sufficient in terms of scope and quality as a partial fulfilment for the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

Signature :……...

Supervisor Name : Ts Mohd Hairizal Bin Osman

Date :……..

DEDICATION

I dedicated this thesis to my beloved father, Mr Shariff Bin Hashim and also my beloved mother, Mrs Rosmini Binti Shaari, and my little brother Ammar Syafiq for giving a lot of moral support, encouragement and also concern about me. Also special thanks to my supervisor Mr Hairizal Bin Osman, for the patient, understanding and also the guidance for me to finish this thesis.

ABSTRAK

Projek ini dijalankan untuk mengkaji memakai sayap menggunakan boron besi yang tidak bersalut pada aluminium. Mesin larik CNC digunakan untuk menjalankan proses pemesinan alat pemotong boron dengan sisipan bersalut dan tidak bersalut. Percubaan ini memberi tumpuan lebih terperinci mengenai memasukkan alat pemotong boron. Faktor yang harus dipertimbangkan pada pemesinan adalah kelajuan gelendong, kedalaman pemotongan dan kadar suapan. Kelajuan gelendong yang telah dipilih adalah 100m / min, 200m / min dan 300m / min dan untuk kedalaman pemotongan dan laju suapan adalah malar pada 0.5mm, 0.10mm / min. Bahan spesimen yang telah digunakan adalah Aluminium AA 6061. Tujuan projek ini adalah untuk mengkaji memakai sayap insertor boron. Kemudian, terdapat beberapa ujian yang dijalankan ke atas projek ini seperti Pengimbasan Mikroskop Elektron (SEM), Tribology, X-Ray Diffraction dan Digital Microscopy. Selepas itu, data boleh diperolehi melalui ujian.

ABSTRACT

This project was carry out to study the flank wear using uncoated boron steel on aluminium. CNC turning machine was used to run the machining process of the boron cutting tool with coated and uncoated insert. This experiment is focus more detail on the boron cutting tool insert. The factor that should be consider on the machining are spindle speed, depth of cut and feed rate. The spindle speed that have been chosen are 100m/min, 200m/min and 300m/min and for the depth of cut and feed rate is constant at 0.5mm, 0.10mm/min. The material of the specimen that had been used is Aluminium AA 6061.The aim of this project is to study the flank wear of the boron insert. Then, there are several testing conducted on this project such as Scanning Electron Microscopy (SEM), Tribology, X-Ray Diffraction and Digital Microscopy. After that, the data can be obtained by the testing.

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LIST OF SYMBOLS

CNC	-	Computer Numerical Control
TiAlN		Aluminium Titanium Nitride
AlCrN		Aluminium Chromium Nitride
TiN's		Titanium Nitride
B	-	Boron
Be		Beryllium
Cr		Chromium
mm	-	Millimeter
hv	-	High Voltage
wt		Weight
Std Dev		Standard Deviation
C	-	Celcius
L		Length
GPA	-	Grade Point Average
XRD		X-Ray Diffraction
SEM		Scanning Electron Microscopy
HRC		Rockwell C Hardness
COF		Coefficient of Friction

CHAPTER 1

INTRODUCTION

1.0 Introduction

By using the lathe machine, this chapter provides an overview of the comparison tribology inserts of different coated and determines the optimum setting of parameters for boron steel processing. The following describes the background of the issue and the problem statement. Research goals are followed and the scope of the study involving the type of coating is selected. The main objective of this chapter is to give readers full knowledge of previous studies and special information about the round inserts using boron steel with different coatings and analyse the best parameter.

1.1 Background

This project is about to create and produce the round insert with boron steel for cutting tools using CNC lathe machine to cut the material. The previous round insert, usually used carbide as a material for the insert because of the advantages of strong steel machining. The profile provides a stronger tool on sharp corners without being susceptible. Other than that, carbides inserts can also counteract high temperatures generated by hard steels with an aluminium oxide coating.

Boron is a tiny membrane element which has been applied to destroy completely and deoxidized steel to enhance toughness. Boron-treated steels are produced with an added boron range of 0.0005 – 0.005 percent and are most useful in lower carbon steels < 0.40 percent C. Boron increases the strength of heat-treated steels in the quenched and tempered condition. By pressing, bend and forging, boron steel grades can be worked hot using cooled tooling. Hot working temperature quenching that produces a high speed cooling rate and a carburizing microstructure that is immediately tempered to produce high strength, tough, hard, durable and wear-resistant components.

A metal lathe or metal lathe is a large class of lathes designed for the precise machining of materials related to durability. However, with the advent of plastics and other materials and their inherent versatility, they were originally designed to machine metals. They are used in a range of applications and a large variety of materials. In machining, where the larger context is already understood hey are usually simply called lathes or referred to by more particular subtype names such as tool room lathe, turret lathe and others. These rigid machine tools remove material from a rotating work piece via the movements of various cutting tools such as tool bits and drill bits. However, with the advent of plastics and other materials and their inherent versatility, they were originally designed to machine metals. They are used in a variety of applications and a wide variety of materials.

The cutting tool will be used for this project with insert which has been uncoated with Alnova, Alcrona, Latuma and the last one. Aluminium AA6061 will be used for the material. The material has excellent weld-ability and produces a uniform and is considered one of the best carburized parts steel. Aluminium AA6061 provides an excellent balance of strength, toughness and ductility. It also provided higher mechanical properties and improved machining characteristics. In relation, this material is commonly used for cutting, bending, crimping, special bolt and much more in its manufacturing industries.

This project will result in an optimization process for cutting parameters such as feed rate, spindle speed depth elimination in laser cutting process for Aluminium AA6061 in order to achieve the optimization parameter. Tool wear analysis technique will identify this experiment's layout.

1.2 Problem statement

After the machining turning machining, there are a few conditions of part that appears. It might be of three factor which are cutting speed, feed rate and depth of cut. In this project, the insert cutting tool will be test on several testing to identify the tool wear of the insert cutting tool. For the previous experiment, recently the material used for the insert cutting tool was mild steel and the observation shows that the material is quite to wear. Therefore, after the discussion, boron steel had been chosen to create a cutting tool insert. Then lastly, after finish all the machining, the insert will be tested to see whether the material is suitable or not for the application.

1.3 Objective

Based on observation for the problem statement that have been found, the purposes of this project are:

1. To analyse the comparison tribology of different coated and uncoated.
2. To study the flank wear of insert cutting tool
3. To study the strength and hardness boron steel of the insert.

1.4 Scope

This research was analyse to identify the tool wear between different insert of coated and uncoated cutting tool. There are 4 types of insert from boron steel that will analyse which are three from coated insert and one uncoated with dimension of diameter 12mm. The coated that were conduct in this experiment are Latuma, Alnova and Alcrona. After that, the most thing that important to be considered is the parameter of the machining. The three factor of the parameter in the CNC turning machine are feed rate, spindle speed and depth of cut. For this experiment, it have 3 different parameter of the spindle speed then, constant at the depth of cut and feed rate. The material that will be used for the test cut is Aluminium AA6061 with dimension 300mm x 50mm.

1.5 Report Outline

This writing of the report consists of five chapters consisting of introduction, review of literature, methodology, outcomes and discussion, and finally the conclusion. First, there is an introduction to chapter one. This chapter was fully explained about this project's concept, the study's objective, problem statement, and scope of the project. The next chapter is the literature review, in this chapter is stated the related pass research on the round inserts using lathe machine with coated and uncoated. The researchers involved come from the source of international research. So it means that this chapter's related research comes from both in the country and abroad. The third chapter is fully explained how the basic till the end of this project is to be built. The next chapter, which is chapter 4, shows all the recorded results for this study. All the results are shown in chapter 4. Finally, Chapter 5 is the conclusion and this whole study was concluded.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter provides an overview of the selected article related to the project title. The main purpose of this chapter is to provide the readers with a deeper understanding of previous studies and technical information on the above techniques. This chapter also classifies the techniques and the strategies to investigate the challenges in an efficient manner.

2.1 Turning Process

Turning is a quite important process of machining whereby a single point cutting tool eliminates excessive material from a rotating cylindrical work piece's surface. In a direction parallel to the axis of revolution, the cutting tool is fed linearly. Turning is performed on a CNC lathe, which gives the power to turn the work piece at a given rotating speed and to feed the cutting tool at a different cutting speed and depth. Thus, in a turning operation, three cutting parameters which are cutting speed, feed and cut depth need to be indomitable. The purpose for the process of turning is to create low parts surface roughness. The roughness of the surface is another major factor for assessing cutting performance. Surface roughness plays a vital role in many areas and is a major factor in the machining accuracy assessment. Figure 2.1 shows the turning process. (Aaditya Kumar, 2017).

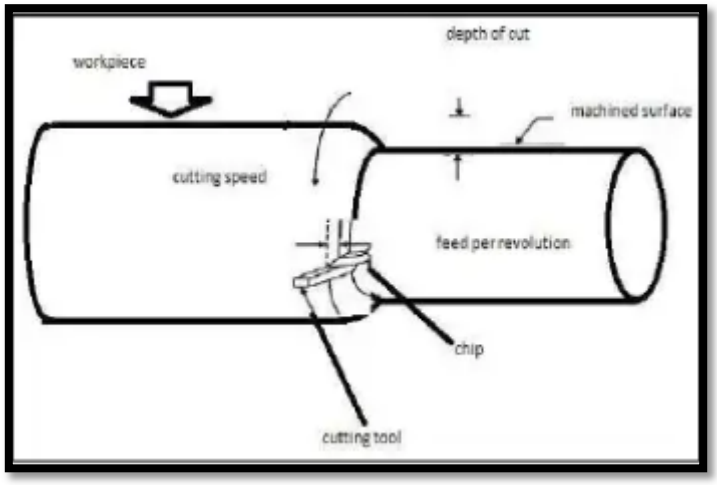

Figure 2.1: Turning Process (Aaditya Kumar, 2017)

Turning process is a method of machining, a process extracted from the material that is used by cutting unnecessary material to produce rotational pieces. Then, a turning machine or lathe, work piece, fixture and cutting tool is needed for the turning process. The work piece is a piece of pre-formed material that is fixed to the fixture that is connected to the turning machine itself and allowed to rotate at high velocities. (Ivan Sunit Rout, 2014).

2.1.1 Turning Machine

This tool can be used in a variety of sizes and models, usually referred to as lathe. Although most lathes are horizontal turning machines, often vertical machines are used, usually for work pieces with wide diameters. It is also possible to classify turning machines by the type of control offered. In turning operation, a manual lathe requires the operator to control the cutting tool's motion. Turning machines can also be operated by computers, in which case they are referred to as a CNC lathe. Fundamentally, CNC lathes rotate the work piece and shift the cutting tool based on pre-programmed commands giving very high precision. The main components of the work piece to be turned and the cutting tool to be inserted into the work piece remain the same in this variety of turning machines. (Ivan Sunit Rout, 2014)

2.1.2 Computer Numerical Control (CNC) Turning Machine

The CNC turning machine is usually control by a CNC machine. Most CNC machines, provide a variety of physical buttons. However, as a simple operations are best performed on cheap / basic / manual machines and it also is a rare machine which can be used manually. Once automatically using a CNC machine, it is used well below its capacity and requirements. (1 Venkata Ramesh Mamilla, 2016)

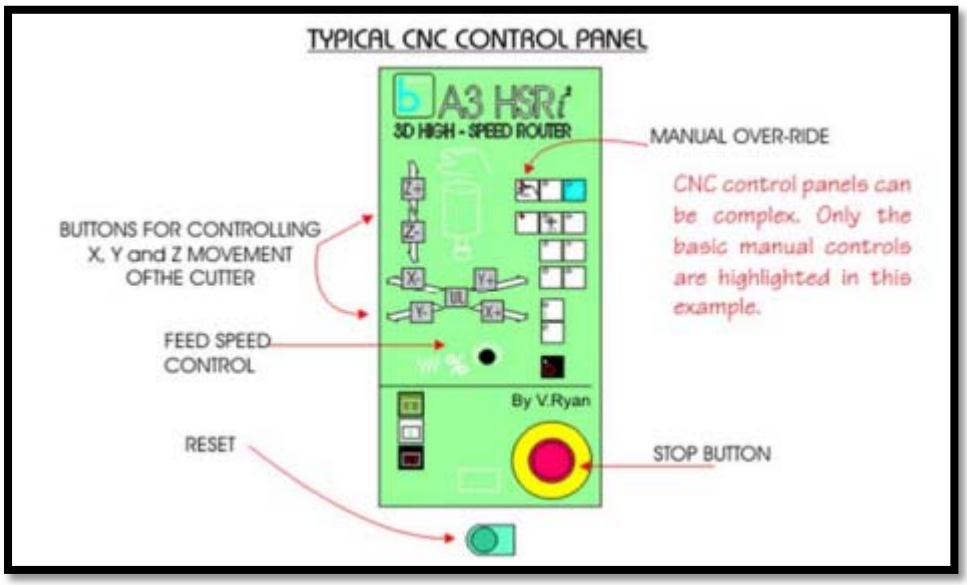

Figure 2.2: CNC Control Panel (1 Venkata Ramesh Mamilla, 2016)

According to (R Rudrapati, 2016), Computer-controlled numerically (CNC) turning has become one of the fully automated process which produces better productivity improvement with consistently better quality components. CNC turning had also confirmed to be really flexible and valuable in most advanced manufacturing industries due to many benefits. The surface roughness of the turned part is strongly affected by process parameters in the CNC turning process. Generally, to obtain the desired surface roughness value, the process variables must be controlled and optimized.