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MELAKA

Study of surface integrity of AISI D2 Steel when machined with uncoated and coated carbide.

Thesis submitted in accordance with the partial requirements of the
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By

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as partial Fulfillment of the requirements for the degree of Bachelor of Manufacturing Enginering (Manufacturing Process). The members of the supervisory committee are as follow:

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ABSTRAK

Kertas ini membentangkan hasil kajian yang dibuat terhadap kesan permesenan mata alat yang disalut and tidak bersalut. Bahan kerja yang dipilih untuk projek ini adalah AISI D2 keluli berkarbon tinggi. Alat pemotongan bersalut yang digunakan adalan TiC (Titanium Karbida) dengan alumina sebagai substrat seramik. Alat pemotongan akan diuji dengan manggunakan mesin larik CNC dan kemudian akan di analisis untuk mengkaji prestasinya. Mata alat bersalut yang telah di pilih akan diuji dalam 4 keadaan yang berbeza. Di mana hanya satu parameter yang berbeza dikenakan iaitu kelajuan pemotongan. Kedalaman pemotongan dan kadar suapan adalah tetap untuk semua keadaan latar . Pada keadaan pemotongan , ciri-ciri kesan yang diukur termasuklah kasar pemukaan dan tekstur permukaan. Alat penguji kasar permukaan, mikroskop elektron penskanan (SEM) dan mikroskop optik akan digunakan untuk memeriksa integriti permukaan

ABSTRACT

This paper presents the experimental investigation that will be done on the machining performance of coated and uncoated cutting tools. The workpiece materials selected in this project is AISI D2 high carbon steel. The coated cutting tools that will be used is TiC (titanium carbide) with the substrate of ceramic which is alumina (Al_2O_3). The cutting tools will undergo machining tests by using CNC turning machine and then it will be analyze in order to study their performance. The selected coated cutting tools will be test at various cutting condition which involved 4 setting conditions. There will be only one parameters varied which is cutting speed. The feed and depth of cut will keep constant for all the setting conditions. At the above cutting condition, the performance characteristics measure includes the surface roughness value and surface texture. A surface roughness tester, scanning electron microscope (SEM) and optical microscope will be used to examine the surface integrity.

DEDICATION

First and foremost, , I would like to express my greatest appreciation to Universiti Teknikal Malaysia Melaka for giving me the opportunity to undergo my final year "Projek Sarjana Muda" under the supervision of Mr. Mohd Hadzley Bin Abu Bakar. A special thank you also goes to my supervisor Mr. Mohd Hadzley Bin Abu Bakar for his dedication and guidance during the period of undergoing my project. Last but not least, I want to thank my mom and dad for their support as well as to all my friends who never give up encouraging me to complete this report.

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Thank You.

Your sincerely,

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Student of Faculty of Manufacturing Engineering

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

SEM – Scanning Electron Microscope

TiN – Titanium Nitride

Al_2O_3 –alumina (ceramic)

Ra – Surface Roughness

TiC-Titanium Carbide

CHAPTER 1
INTRODUCTION

1.1 Background of project

Trends in the manufacturing industry have drive trends in metalcutting insert developments. Changes in workpiece materials, manufacturing processes and even government regulations catalyze parallel advances in metalcutting tooling technology B. Arnold (2000).

Coated tools have found widespread use in today's metal cutting industry, bringing about significant improvements in tool performance and cutting economy through lower tool wear, reduced cutting forces, and better surface finish of the workpiece.

This project investigates the surface integrity of AISI D2 steel when machined with uncoated and coated carbide. The methodology used in this project is experimental procedures. In the experiment that will be done, the tools must undergo a machining test on the surface integrity condition before analysis can be done.

Experimental will be performed by using CNC Haas turning machine and the varying cutting parameters involved are cutting speed. Feed, depth of cut will be kept constant since it does not given any significant effect on the tool life. (Steve F.Krar, 1997)

1.2 Problem Statement

Wear resistant coating on cutting tools is the most significant development in cutting tool technology. Performance of coated tool relative to that of uncoated carbide was evaluated in CNC Haas turning under dry machining. The uncoated cutting tools reveal their weakness in machining material AISI D2 steel. The uncoated tools suffer from rapid wear because of dry machining during turning operation. (Sahoo B, 2002).

Flank wear is significantly lower than that of uncoated tools, and flank surfaces can be reground after use since regrinding the tool does not remove the coating on the rake face of the tool. However, coated tools do not perform as well as low cutting speeds because the coating can be worn off by chip adhesion; therefore, the use of appropriate cutting fluids to discourage adhesion is important. (Kalpakjian and Schmid, 2001)

Although the used of the coated cutting tools have much benefits in application in local industry, but most of the coated cutting tools are imported. So, this study is important in order to get knowledge of coated cutting tools in industrial applications and in producing these cutting tools locally. (Thesis Atikah, 2005)

1.3 Objectives

The objectives of this experiment are:

a) To analyze the surface integrity of the material based on coated and uncoated cutting tools used during machining operation.

b) To study the relationship between surface roughness values and turning parameters such as cutting speed.

1.4 Scope of project

The scope of this project is to perform machining operation for AISI D2 steel by using uncoated and coated cutting tools by using CNC Haas Turning machine. The parameter varying is cutting speed while feed rate, depth of cut and cutting time are kept constant. The performance measure to be evaluated is surface integrity.

CHAPTER 2
LITERATURE REVIEW

2.1 Metal Machining

Machining is a process designed to change the size, shape, and surface of a material through removal of materials that could be achieved by a sharp cutting tool. (Molian, 2006).

Machining is important because variety of work materials can be machined. This is most frequently applied to metals. It is also produce variety of part shapes and special geometry features such as screw threads, accurate round holes and very straight edges and surfaces. Other than that, machining can produced a good dimensional accuracy and surface finish.(Dr. M.Madraj, 2001)

Machining is usually divided into the following categories:

a) Abrasive processes – material removal by hand, abrasive particles, e.g., grinding.

b) Nontraditional processes – various energy forms other than sharp cutting tool to remove material.

c) Advanced machining processes – utilize electrical, chemical, thermal, and hydrodynamic methods, as well as lasers.

d) Cutting-involves single-point or multipoint cutting tools with a clearly defined tool shape.