CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

In general, eventual tool wear is tool failure. Tool wear plays a vital role in influencing both the ease of cutting and the quality of the resultant machined surface [1]. There has been a significant amount of research dedicated to understanding the failure mechanism of the cutting tool. One of the factors that influence the failure of the cutting tool is depending on the tool behaviour. Tool behaviour is influenced by many factors which include the composition of the tool material, the steel workpiece, the nature of cutting operation, the cutting conditions and the tool geometry.

There are several wear of the cutting tool that occurs during hard turning process. The mechanism most commonly used to explain the wear of tools includes cracking and chipping, abrasion, adhesion, diffusion and chemical wear. All of the wear can be observe by using scanning electron microscope (SEM) or optical microscope. This paper presents an experimental study of hard turning with polycrystalline cubic boron nitride (PCBN) tools to investigate the relationship between PCBN tools with failure mechanism that will be occurred in different cutting speed, feed rate, and depth of cut.

1.2 OBJECTIVES

i) To investigate relationship between failure mechanisms with polycrystalline cubic boron nitride (PCBN) tools in turning process.
ii) To study the effect of machining parameters such as cutting speed, feed rate and depth of cut in PCBN tool.
iii) To recommend the optimum parameter for finishing cutting conditions of PCBN tools.

1.3 PROJECT SCOPES

i) Failure mechanism in polycrystalline cubic boron nitride (PCBN) tools using conventional lathe machine when machining hardened steel AISI 4340 of 60 HRC.
ii) Conduct the experiment at different spindle speed, feed rate and depth of cut.
iv) DOE methodology is applied to define the main parameters and relationship between parameters.
v) The wear of PCBN tools occurred is examined using optical microscope.

1.4 PROBLEM STATEMENT

Hardened steel parts are widely used in the automotive, gear, bearing, tool, and die industry. A recent study reports that the automotive industry increasingly using hard turning more than grinding gear-stem machine. So that they can eliminate the need of grinding parts for finishing. By eliminating this process, the automotive industry reduced capital out-lays by as much as 40% and increased production by approximately 30% [2]. One major problem in turning the hardened steels is the tool wear caused by the hardness of the material. Polycrystalline cubic boron nitride (PCBN) cutting tools have found widely acceptance in machining a variety of hard materials [3]. Thus, the study of tool wear and the damage caused to the cutting tool in PCBN is quite important in order to reduce wear rate so that it will suitable for precision applications and offer better performance improvements.