

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION**

Tungsten carbide, or commonly known simply as carbide is a widely used cutting tool in machining processes. As carbides are used during machining, gradual wear on the flank and the rake faces of the cutting tool causes carbides to fail. Coating promotes longer tool life to tungsten carbide cutting tools because coatings increase cutting tools' hardness. Sandblasting pre-treatment has to be done to tungsten carbide before coating process to ease adhesion of coating to cutting tools.

According to Parker (2003), "cutting tool is the part of a machine tool which comes into contact with and removes material from the work piece. Meanwhile, coating can be defined as a thin film bonded to a base material". The capability for increased productivity is the most important advantage of using coated carbide inserts. With no loss of tool life they can be operated at higher cutting speed than uncoated inserts. Longer tool life can be obtained when the tools are operated at the same speed (Geng, 2004).

According to Destefani (2002), "PVD or physical vapor deposition is the major process used in the production of cutting tool coatings. PVD emerged as a viable process for applying hard coatings to cutting tools". In PVD, the coating is deposited in a vacuum chamber. The coating reacts with gas in the chamber and is deposited onto the substrate. Because PVD is a low-pressure process, the coating atoms and molecules undergo relatively few collisions on their way to the substrate. PVD is therefore a line-of-sight process that requires moving fixtures to ensure uniform coating thickness.

## **1.2 PROBLEM STATEMENT**

The tool of a turning machine plays a great role in turning process. Poor tool will tend to wear faster and has shorter time of usage. Changing the tool repeatedly due to tool wear and short tool life should be prevented manufacturing process as it will affect productivity of a company. A more severe case is when sudden failures of cutting tools happens and lead to loss of productivity, rejection of parts and consequential economic losses. To increase the cutting tool's life, improvements need to be done using surface pre-treatment and coating process. One of surface pre-treatment technique is sandblasting. Sandblasting pre-treatment is used to remove cobalt layer on cutting tool to improve coating adhesion. Coating is used to solve short tool life problem. Applying coating to tungsten carbide cutting tool can increase hardness, increase wear resistant, and also can increase tool's life. Therefore, the current work focused on improving the wear resistance of tungsten carbide cutting tool in machining with titanium work piece in turning operation. The main objective of this study is to increase the carbide cutting tool's life.

## **1.3 OBJECTIVES**

There were three main objectives to be fulfilled in this research which had been listed as follow:

- (i) To evaluate the effect of wear resistance of coated and uncoated tungsten carbide cutting tools after turning process
- (ii) To determine the effect of sandblasting pretreatment onto tungsten carbide's surface morphology prior to coating
- (iii) To distinguish the effect of coated and uncoated tungsten carbide cutting tools onto machining performance by using different cutting speed.

## 1.4 SCOPES

These are the scopes of this research:

- (i) Tungsten carbide (WC) will be used as substrate material or cutting tools.
- (ii) Silicon carbide (SiC) will be used during sandblasting pretreatment process to the cutting tools surface.
- (iii) Coat the cutting tools with diamond-like carbon by PVD technique.
- (iv) Machining cutting tool to titanium work piece by using turning operation.
- (v) Evaluate the wear rate resistant of the cutting tool, hardness and surface roughness.