CHAPTER 1

1.1 INTRODUCTION:

Powder metallurgy is the production method that have great potential for further development. It is the best alternative to all producer methods such as casting, forging, and investment casting process or other machining process. Powder metallurgy is the method that allows for certain materials and products with special properties to produce complex shape with high thermal, good reflection, good electric conductivity, excellent corrosion resistant and high compact strength. These technical processes are economical and easy to find. Waste free production, which raw material wasted is less compare by other casting and subsequence machining. This allows product can be produced in low price and competitive to market.

Powder metallurgy consists of three simple phases. First is blending between two powders, next compacting the mixture powders in die at room temperature at rate 138 Mpa to 827 Mpa, lastly sintering at the controlled temperature furnace at rate 1000 degree Celsius to make particle bonding together to reach at certain hardness [13]. Due to waste free production, these technologies only produce scrap rate at 3 percent. Because the process produces small percent of waste, it frequently completed when taken from the furnace. The process is very cheap and effective compare to other manufacturing processes which must content flash, machining chip, spread bush, gate and runner.

Obviously, powder metallurgy process contains many advantages. Powder metallurgy is the strongest advance in order to eliminate or minimize machining. Complex shape and high tolerance can easily produce by powder metallurgy. These days, close dimensional tolerance is the one of the secret to successful acceptations in the conversion of many components from contending forming latest technology [13]. This gives benefit to enhance no limits to form of alloy system that can be used to develop shaped components. The analysis material can considerable parallel in duplicate function.
and application demand with a material system meet needed such as corrosion resistance, hardness, mechanical properties or other particular metallurgy.

Aluminium oxide, as known as alumina natural compound that use in various industries, most particularly for production of aluminium. There are two forms of alumina, crystalline and non-crystalline. It is insulator which means, it does not conduct electricity and it also has comparatively high thermal conductivity. If it is on crystalline form, example corundum, its hardness make it worthy as an abrasive [12]. The higher melting point of aluminium oxide makes it better for fractious material for lining high-temperature appliances. In other hand, metallic aluminium and oxygen reaction, which may could gain corrosion. But still, when the aluminium bond between oxygen to form aluminium oxide, it create a thin covering that protects it from oxidation. This can keep aluminium from rusting and losing durability. The thickness and other attributes of the oxide layer can be switched by using the anodizing process.

Copper powder used to reinforce with aluminium powder because copper powder is known as the best self-lubricant holding which was the genuine application and still records for around 70% of the grainy copper powder utilisation[14]. This application exploits the capacity to make a segment with controlled interconnected and surface-joined porosity. The output of metallic channels likewise exploits this ability. The pure copper powder is utilized as the electrical and electronics component because of its good thermal conductivities. Copper is used as an alloying element in iron powder segment to empower the mechanical properties and control dimensional changes amid sintering. The summation being made either using blending or by penetration. Copper powder melting point is around 1084.62 °C or 1984.32 °F.
1.2 PROBLEM STATEMENT:

Currently, the cutting tool used advanced material such as titanium carbon nitride (TiCNi) and nano coating which are very expensive and hard to find. The properties of tool cutter are affected by its stiffness, thermal, electrical properties and strength. Basically, powder metallurgy needs a strong compact and then heat at high temperature to make bond combine and become stronger.

This project is to study the correct mixture between aluminium oxide combine with copper powder using ball milling. These combinations will determine either it will hardness or brittle. Adding a lot of copper will be resulting corrosion due to chemical reaction. Mixing both compounds also need additives to make it stick together, whether using wax or other lubricants.

For instance, all cutting tools are exposed to high temperature. Copper is used because it useful in high temperature and provide good mechanical characteristic as well as high thermal conductivities. Copper properties will enhance the strength of aluminium composite by making the surface harder compared to pure aluminium.

1.3 OBJECTIVE:

The aim of this project:

1) To develop insert using alumina reinforced with copper powder.
2) Fabrication die for the production inserts.
3) To analyze the physical and microstructural properties of insert after compaction and sintering.
4) To develop high strength cutting tool at lowest price.