

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION**

The AISI P20 is hardenable steel used frequently in the manufacturing of polymer injection molds. Some of the typical applications of P20 are plastic injection molding mold, backers, bolster and die holder. P20 is also widely used in the production of plastic mold and die. Due to its requirement Wire Electrical Discharge Machining (WEDM) were choose to produced mold and die.

WEDM been widely used in aerospace, nuclear, automotive industries, surgical components because of it capability of producing high-precision parts. Apart of producing high-precision machining results, increasing demand for quality machined surface made WEDM has been extensively used by many industries such as die-making industry and mold-making industries because the machine also is capable of producing very fine surface finish. This could eliminate secondary process required such as surface finishing. The ability of this CNC machine to move for machine axes to generate taper cut makes WEDM were used to machine profile with precise, complex and irregular shapes in various difficult-to-machine electrically conductive materials.

Surface roughness is a machining characteristic that plays a very critical role in determining the quality of engineering components. Some benefits of having good quality surface are improved fatigue strength, corrosion and wear resistance of the workpiece

(Spedding and Wand, 1997). Selection of the optimal values for different process parameters of WEDM process is observed to be of immense importance to enhance the machining performance measured.

## **1.2 PROJECT BACKGROUND**

Plastic injection molding is a versatile process capable of producing complex shape with good dimensional accuracy and one of the most used manufacturing technologies for mass produced goods. However, to get a better mold surface roughness requires a wide availability of knowledge of design and processing as well as equipment in many variations. Mold surface roughness affects the physical performance of the part where every customer judge works by the surface quality. It is more easily, and much reducing money and time consuming if we perform steps to get a good mold surface than to touch up every part after it is finished.

Present development and application of WEDM is able to produce fine surface finish for the injection molding mold. The main problem is different material use different machining parameters in order to archive good surface finish. Machined surface produced by WEDM process consist of many crates where will result in low quality of surface roughness. This may happen if unsuitable machining parameters were used. To overcome this problem, many researchers working toward to investigate the best machining parameters can be used for every type of material.

This study purpose is to investigate the effect of WEDM machining parameters on surface roughness of tool steel material (P20) for injection molding.

### **1.3 PROBLEM STATEMENT**

AISI P20 is among the best material used for injection mold making. Mold that is made using WEDM process require knowledge on the optimum machining parameters. Machined surface with good quality can only be obtained through best combination of machining parameters. Voltages, wire speed, wire feed and wire tensions are some of the machining parameters that affecting the roughness of machined surface. Main problem in operating WEDM is wire breakage (Amorim and Weingaertner, 2005). Inappropriate machine parameters used may lead to wire breakage. Besides lowering surface machined quality, wire breakage can cause increasing work time and cost of tool. This can give effect to various manufacturing field especially in industries where demand of products are always high. The purpose of this research is to investigate what are the parameters suitable to use for cutting P20 tool steel material in order to get smoother machined surface while avoiding wire breakage from occur.

### **1.4 OBJECTIVE**

The objective of this project is:

- i. To investigate the effect of WEDM machining parameters on surface roughness of P20 tool steel material for injection molding.

### **1.5 SCOPE OF PROJECT**

Material that will be used in this experiment is P20 hardenable steel material that used in injection molding making. The cutting tool that is used is copper wire with diameter 0.2mm. Machining input variables that considered in this experiment are wire speed, voltage and machine feed rate while surface roughness of the machined material will be the