

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Laser is an acronym of Light Amplification by the Stimulated Emission of Radiation. It is electrical-optical devices that produce coherent radiation. The concept use in developing laser is the concept of stimulated emission which was first suggested by Albert Einstein in 1916.

Lasers are commonly seen in several ordinary commercial applications, such as bar code scanners, laser pointers, CD players, CD-ROMs, videodiscs, laser surgery, and laser-light shows. However, lasers have many other applications as well such as machining process in manufacturing industries. The example of application of laser in machining process is laser cutting process. In this process, laser beam is utilized as a machining tool.

In industrial field, laser is a flexible machine tool. In manufacturing industries as example, laser is uniquely versatile tool for processing a remarkable range of metals, alloys, ceramics, glasses, polymers and composites. Light can be produced in pulsed or continuous form with different wavelength and power level. Laser processing has greater advantages compared to the traditional methods of industrial fabrication. It can be a profitable replacement for an existing technique. This is differs to the traditional machine tools that are normally designed for a particular purpose. They are also perform to the most exacting standards but they can only perform a particular task.

Acrylics are esters of acrylic acids, which are the products formed by the reaction of an acrylic acid and alcohol. The esters of acrylic acid polymerize readily to form exceptionally clear plastics. Acrylic is a useful, transparent thermoplastic that resembles glass, but has properties that make it more superior to glass in many ways. It can be describes as new world material because it was first was developed by DuPont in 1944 and was first commercially produced in 1950 [11].

Acrylic is defined as a manufactured fiber in which the fiber forming substance is any long-chain synthetic polymer composed of at least 85% by weight of acrylonitrile units. Acrylic fibers create a fine, soft and luxurious fabric with the bulk and hand of wool. The most common acrylic plastic is polymethyl methacrylate (PMMA), which is sold under the brand names of Plexiglas, Lucite, Perspex, and Crystallite.

Nowadays, acrylic can be considered as one of the widest material used in industries. Its application is not only covered human daily life, its also applied in military, aircraft applications, construction and etc. During World War II, acrylic glass was used for periscope ports on submarines and for windshields, canopies, and gun turrets on airplanes. Today, acrylic is used more than ever. Virtually all major public aquariums is now built from acrylic.

There are many ways to process the acrylic. One of it is by using laser cutting process. In determining the quality of the cutting, some parameters should be considered. Problem statement will explain about the further information regarding to this project.

1.2 PROBLEM STATEMENT

There are a large number of parameters that control the laser cutting process. Each parameter has its own function which can affect the processing operation. In this project, the most important parameters to be considered is the laser power level range because there is significant relationship between power level and feed rate. The different

laser cut power level range will produce different type of results depends on the feed rate [7].

In laser cutting process, there are various kinds of cut quality parameters. So, in this research, only two laser cut parameters will be investigated which are; striation frequency and the width of heat affected zone (HAZ). These all parameters are depending on feed rate and power level.

1.3 OBJECTIVES

The objectives of this study are:

- i. To analyze the effect of different feed rate values with a constant power value to the width of heat-affected zone (HAZ).
- ii. To analyze the effect of different feed rate values with a constant power value to the striation frequency.

1.4 SCOPES

This research is carried out to verify the laser cut quality by follows the according scopes:

- i. Analyze two laser cut quality parameters.
 - Striation frequency
 - The width of heat affected zone (HAZ)
- ii. Run the experiment using ten values of feed rate (1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, and 1900) with a constant power value (25.5 W).
- iii. Using Carbon Dioxide (CO₂) laser cutter machine and acrylic (Polymethyl Methacrylate, PMMA) as the material to be cut.
- iv. Analyzing the data by using manual calculation.