EFFECT OF LASER ENGRAVING PARAMETERS ON SURFACE MORPHOLOGY AND QUALITY OF STAINLESS STEEL

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in fulfillment of the requirements for the degree of
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DECLARATION

I declare that this project entitled " Effect Of Laser Engraving Parameters On Surface Morphology And Quality Of Stainless Steel " is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

Signature : 

Name : *MUHAMMAD SAFWAN ARIF BIN MOHD SANUSI*

Date : 14/1/2022

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours.

Signature : 

Supervisor Name : *PROFESOR MADYA IR DR MOHD HADZLEY BIN ABU BAKAR*

Date : 14/1/2022

DEDICATION

This was dedicated to my beloved family member mother, Mrs. Shamilla Binti Awang @ Abdullah, my beloved father, Mr. Mohd Sanusi Bin Hasan, my sisters. A gratitude of thank you to my supervisor Profesor Madya Ir. Dr. Mohd Hadzley Bin Abu Bakar that have been helping and supporting me throughout this project and friends. Praise is to Allah S.W.T that I get a very supportive and positive circle that helps me in this project. Last but not least, to all my friends that have been there for me. Without their support, this project would not been made possible.

ABSTRACT

Laser is the most commonly used technology in the various stream such as engineering, medical, design, and also the business. With the different parameter setup there is various process of the laser can be done. One of the process is the laser engraving process. Laser engraving process allowed the engraver or the laser operator to engrave variety surface of the material type with various of design since in the 21th century the laser engraving machine is coordinated automatically. The laser engraving technique itself holds the same concept of past decades of engraving process, which is removing the layer of surface to form the pattern, layer by layer, the only difference is the engraving technique nowadays using the laser to do engraving. With the laser engraving machine, it is possible to produce the product in mass production with a uniform result. The imagination is not limited since various design can be done. For the exact machine that capable of doing the engraving process is, carbon dioxide (CO2) Laser and neodymium-doped yttrium aluminium garnet (Nd:YAG) laser, fiber laser and semiconductor laser. The main goal for this project is to produce the good quality of product by doing the study of the surface morphology by setting various parameter to get the good result of engraving. The material will be observed and examined after the engraving process.

ABSTRAK

Laser adalah teknologi yang paling banyak digunakan dalam pelbagai aliran seperti kejuruteraan, perubatan, reka bentuk dan juga perniagaan. Dengan parameter yang berbeza terdapat pelbagai proses laser yang dapat dilakukan. Salah satu prosesnya ialah proses ukiran laser. Proses ukiran laser membolehkan pengukir atau pengendali laser mengukir pelbagai permukaan jenis bahan dengan pelbagai reka bentuk kerana pada abad ke-21 mesin ukiran laser beroperasi secara automatik. Teknik ukiran laser itu sendiri mempunyai konsep yang sama dalam proses ukiran sejak berdekad yang lalu, iaitu menipiskan lapisan permukaan untuk membentuk corak, secara menipiskan lapisan demi lapisan, satu-satunya perbezaan antara teknik itu adalah, ukiran yang kini menggunakan laser untuk melakukan ukiran. Dengan mesin ukiran laser juga, ia dapat menghasilkan produk secara besar-besaran dengan hasil yang sama. Imaginasi juga tidak terbatas, ini kerana pelbagai reka bentuk dapat dilakukan. Untuk nama mesin yang khusus yang mampu melakukan proses ukiran adalah, laser karbon dioksida (CO_2) ,garnet aluminium yttrium-neodymium-doped (Nd: YAG) laser, laser gentian dan laser semikonduktor. Matlamat utama projek ini adalah untuk menghasilkan kualiti produk yang baik dengan melakukan kajian morfologi permukaan dengan menetapkan pelbagai parameter untuk mendapatkan hasil ukiran yang baik. Bahan akan diperiksa setelah proses ukiran selesai.

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In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, praise Allah the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. I would like to acknowledge Almighty Allah for giving me the chance and opportunity to do my studies, my dedication, and my courage.

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CHAPTER 1

INTRODUCTION

1.1 Background

Engraving is a process that has been existed before the 11th century with a term that is called manual engraving, or the other word is carving. Carving can be done on various types of surface materials, which are clay, ceramic, tile, metals, glasses, wood, and plastic. In the 11th century, carving is an art that has been done on a product such as swords, pots, walls, and metals Carving is a process of removing some surface to create pattern by using friction applied on the surface of the material. Manual engraving or carving is done by using sharp and hard as cutting tools, it includes stones, diamonds, or hard metals.

Figure 1.1 The Part Of The Carved Fallen Walls Of Ancient Egyptian Civilization (https://www.metmuseum.org/toah/images/h5/h5_13.182.3.jpg

The ancient carving tools are the most basic carving tools and they also need more manpower to carve the entire walls and it is a time-consuming process. Figure 1.2 below shows the hand tools that were used in ancient Egyptian civilization to carve the walls. The hand engraving keeps evolving from one civilization to another civilization and its concept of works still the same, which is, removing parts of the surface of a material to create a pattern by using hand tools and applying the force by using the hand tools on the surface of materials to create friction and resulting in a carved pattern on the workpiece. The only thing that change is the hand tools that keep evolving over time, it is getting advance and user friendly.

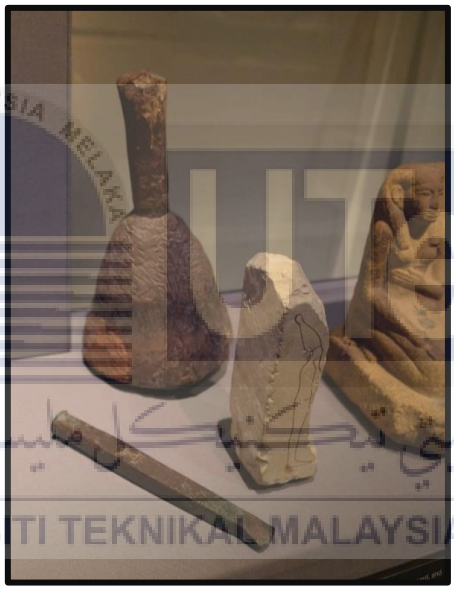

Figure 1.2 Hand Tools To Carve The Walls In Ancient Egypt Civilization (https://i1.wp.com/artsandfood.com/wp-content/uploads/2016/02/Stoneworkingtools.jpg?resize=488%2C640&ssl=1)

(A. M. Hind, 1908) mentioned in his book that engraving is a process that transferring the design onto a hard, flat surface of the material by cutting grooves. The words engraving and the engraving process were reported originated in the Rhine valley in Germany and in northern Italy in the middle of the 15th century. It was developed by a Germany goldsmith who engraved silver and gold as his product at that time.

Figure 1.3 Antique Hand Tools For Hand Engraving Process (https://www.practicalmachinist.com/vb/images/metro/blue/misc/lightbox_progress.gif)

In the early 1960s, Theodore Maiman developed a laser that has been studied on the past theory of Albert Einstein in 1905s where at that time there is only a theoretically mathematically proven about the of stimulated emission of radiation. Then the hand engraving work starts to slow down in the early 1970s when the laser was recognized and introduced in the industry, Kristin Huff (2004). In 1978s Tom "Rudy" Zarden bought the laser and decide to used it to engrave on his artwork, in the late 1980s Will Dahlgren invent the computerized engraving machined which is it is the revolution in laser technology at that time.