

EXPERIMENTAL INVESTIGATION OF LASER CUTTING OF DIFFERENT TYPES OF NON MATERIALS

**Anjali Bhosale¹, Balaji Kesale², Shreeram Bharati³,
Jitendra Dhage⁴, Miss. Pradnya More⁵**

^{1,2,3,4} Student, Mechanical Engg. Dept., JSPM' s Bhivarabai Sawant Institute of Technology and Research,
Wagholi, Pune, Maharashtra, India

⁵ Assistant Professor, , Mechanical Engg. Dept., JSPM' s Bhivarabai Sawant Institute of Technology and
Research, Wagholi, Pune, Maharashtra, India

³Department & university, Country

¹jitendradhage13@gmail.com; ²2nd author email; ³balajikesale9545@gmail.com@gmail.com

Abstract— Recently the use of laser to various kinds of applications has been applied. Therefore, to obtain better result in the development of a cutting machine of different materials using the low power laser, the capability of laser machine of 500 mw in cutting various non- metallic materials has been studied. The material such as different sizes paper, wood, plywood , leather etc. Where cut the material at different cutting speed from the experiment shown that parameters such as current, speed, number of passes, depth of cut, cutting time, power in the process of cutting. The analysis will asset the manufacturing industry a chose a suitable laser system for cutting a non-metallic materials

Keywords—*low power laser diode, laser cutting, laser CO2.*

I. INTRODUCTION

Recently, the application of laser has been widely used in many fields such as manufacturing biomedical, etc. laser stand for light amplification by stimulated emission of radiation. Out of the various applications of laser, this study converges towards its industrial application wherein it is used for cutting various non metal such as papers, wood, plastic, cardboard etc

Laser cutting is the technology used for industrial manufacturing applications laser cutting work by directing the optics are used to direct the material or laser beam generated. A typical commercial laser for cutting materials involved a motion control system to follow a various G- codes of the pattern to be cut onto a material. The focused laser beam is directed at the material, which then either melts, burn, vaporizes away or is blown away by a jet of gas leaving an edge with a high quality surfaces finish CO2 laser cutters are used to cut sheet material as well as different paper, plastics etc.

The example of this application is in cutting process using engraving laser machine by removing small part of the surface of materials with different depth .laser cutting produce a finer finish to end product as compared to conventional cutting method .laser is widely used to cut precise shape in to different materials with varying thickness. Because the laser process is non-contact process wear and tear associated with conventional method is absent .This process preventing the product from any damage and deformation.

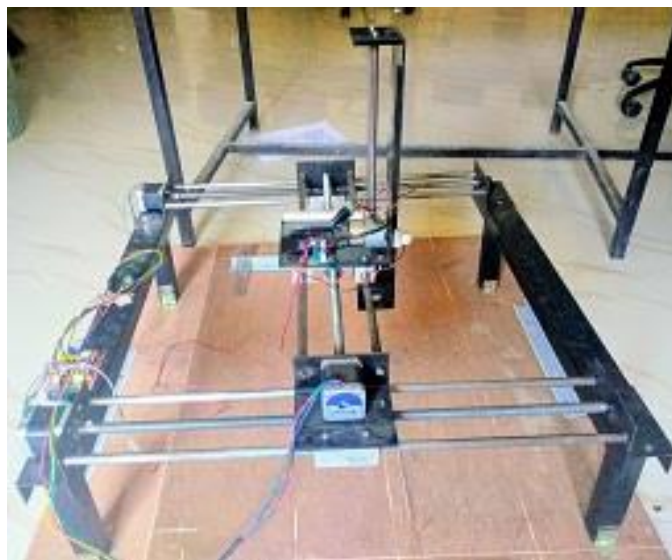
In this experiment, the low power laser diode were used. The analyzed to understand the influence of different parameters such as cutting speed, number of passes, depth of cut, voltage, current, cutting time and power.

II. OBJECTIVES

- 1) Finding out the different parameter such as depth of cut, cutting speed, number of passes
- 2) Also find out required time for works.
- 3) To know the Cutting parameters of different Materials.
- 4) Beam parameters, wave length, power & intensity, beam quality.
- 5) To know how much power, require to cut different types of material with different thickness.
- 6) Cutting speed, gas pressure, focal length.

III. EXPERIMENTAL SETUP

Experimental apparatus is shown in figure 1. To access the capability of low power laser, various materials cut by the laser. The experimental laser cutting process is one in which the laser head is moving and the work table is stationary. The movement of laser head is in X and Y direction by using the softwares by the pc .The 500mw laser used in this experiment. 12 V stepper motors used for the movement of the laser head. The vertical distance between laser head and the work table controlled by the stepper motor .The maximum power of laser is 500mW power is varied as per the requirement of material .The protective shield is used for the safety purpose.



IV. REQUIRED SOFTWARE AND HARDWARE

- SPECIFICATION OF LASER USED

1. Wavelength: 405NM
2. Power: 500MW
3. Electric current :<2A
4. Input voltage: DC/AC 12V
5. Working temperature:- -10~+40 degree c
6. Size:33*33*65 mm
7. Cable length :40 cm
8. Features: Laser adjustable feature

The software required to run this project are:

- 1) java
- 2) arduino uno
- 3) Inkscape
- 4) Universal G code sender
- 5) grbl

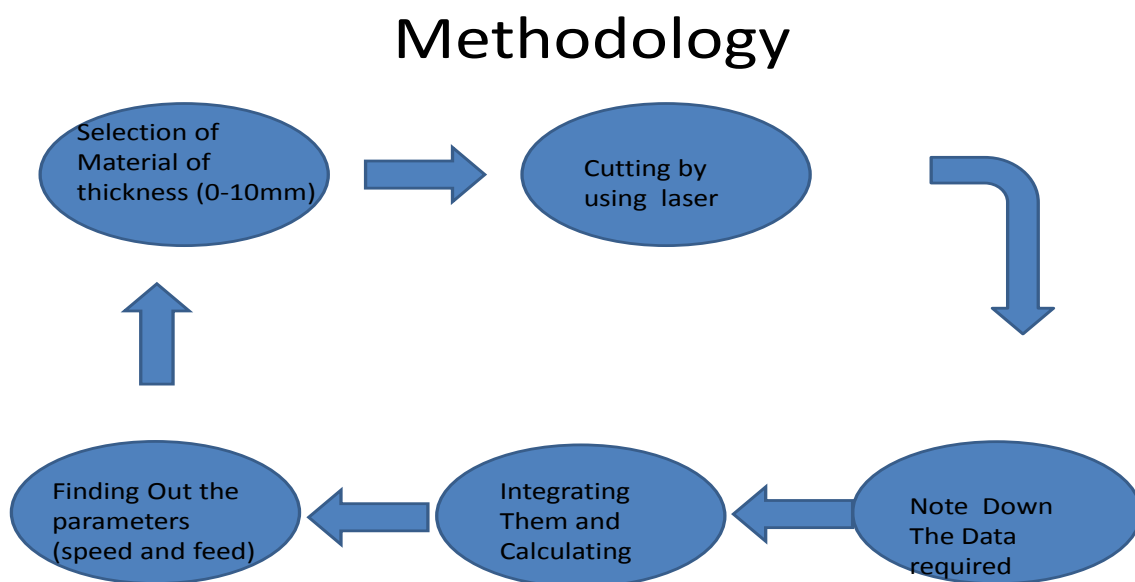
1)Arduino uno 1.8.5:- The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volt.

2)Inkscape: Inkscape is a free and open-source vector graphics editor; it can be used to create or edit vector graphics such as illustrations, diagrams, line arts, charts, logos and complex paintings. Inkscape's primary vector graphics format is Scalable Vector Graphics (SVG), however many other formats can be imported and exported. Inkscape can render primitive vector shapes (e.g. rectangles, ellipses, polygons, arcs, spirals, stars and 3D boxes) and text. These objects may be filled with solid colors, patterns, radial or linear color gradients and their borders may be stroked, both with adjustable transparency. Embedding and optional tracing of raster graphics is also supported, enabling the editor to create vector graphics from photos and other raster sources. Created shapes can be further manipulated with transformations, such as moving, rotating, scaling and skewing.

3) Universal G code sender: Universal G code sender is used to generate the g code. To define the path for laser tool it is necessary to generate the g code defined sketch. This is done by universal g code sender. After generating the g code file, UGS sends g code file to grbl.

4)grbl controller: Grbl Controller is software that is designed to send GCode (which is come from universal g code sender) to CNC shield

V. METHODOLOGY



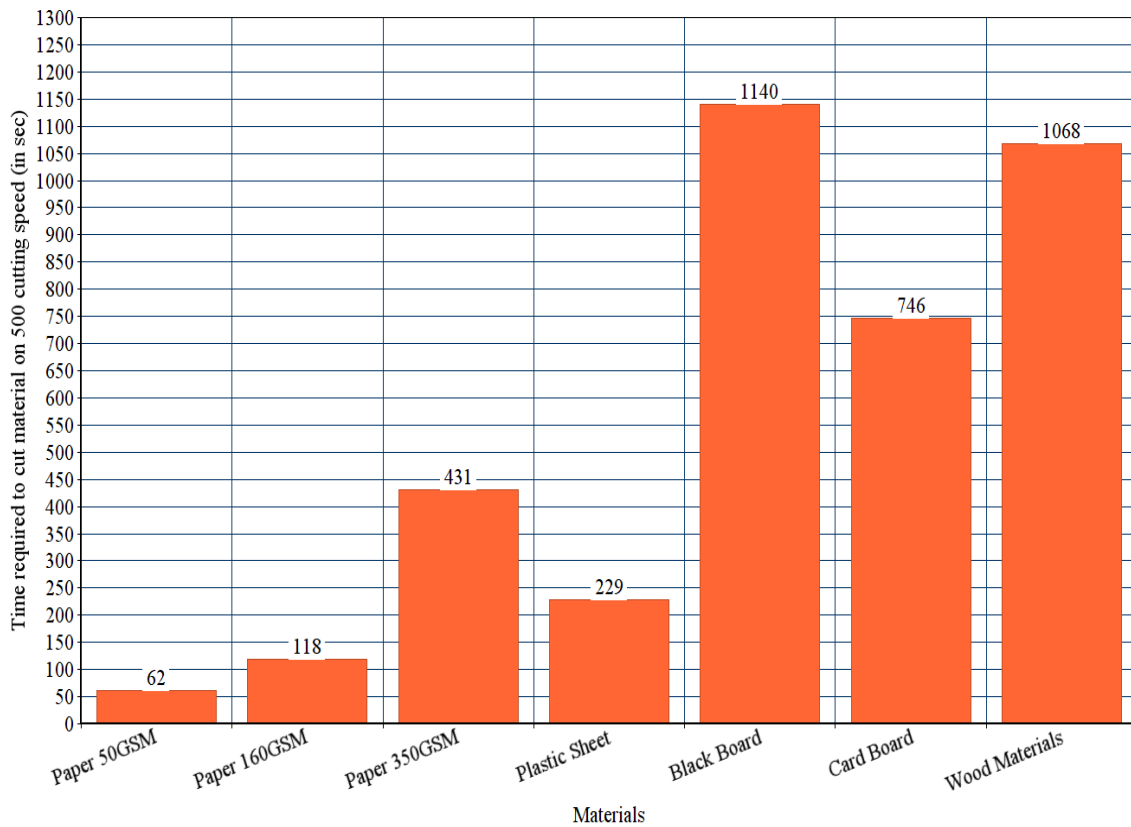
Above procedure is used to calculate different parameters such as speed depth of cut different paper cutting time etc.

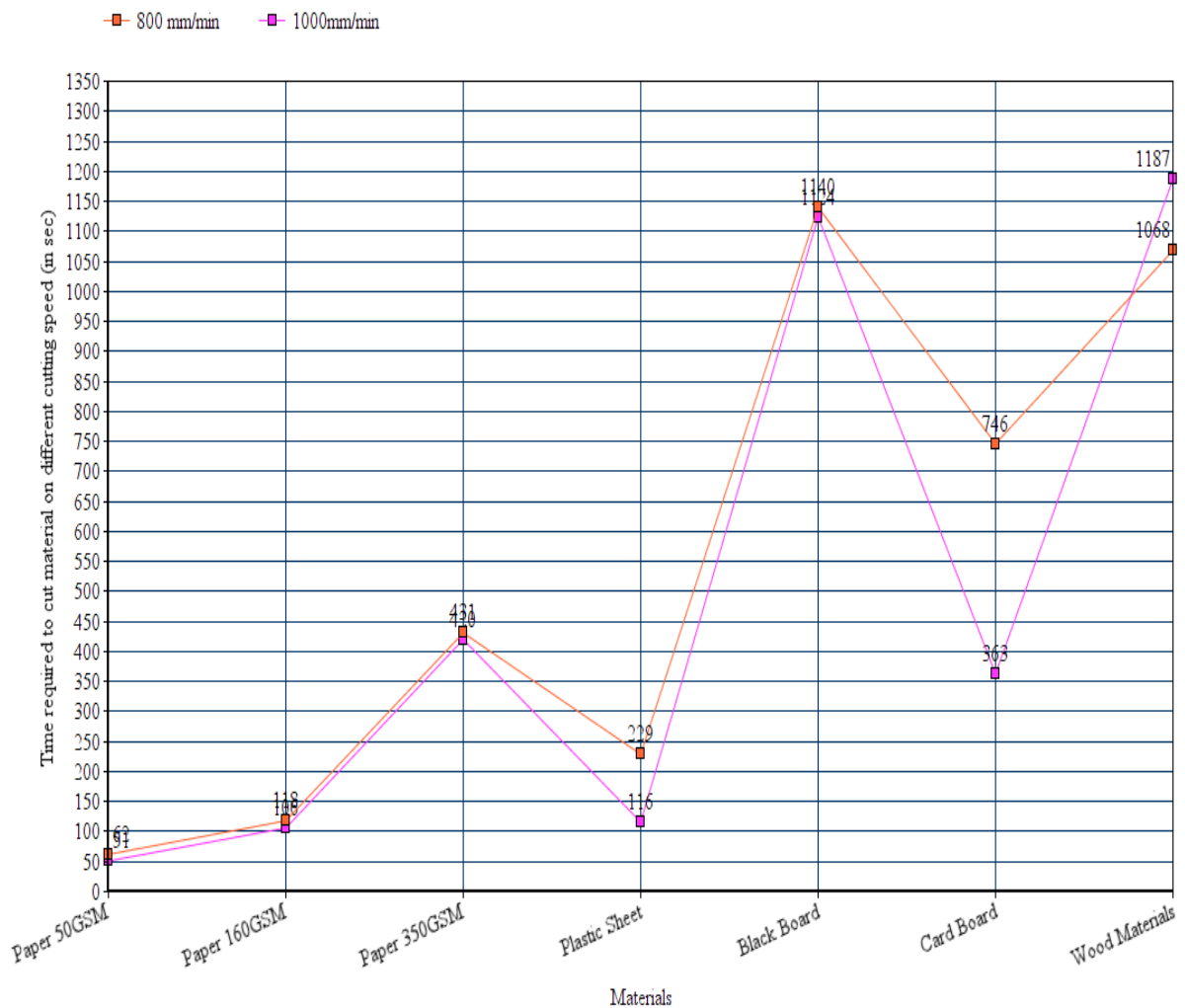
VI. EXPERIMENTAL RESULTS

- Below Table show the results of cutting process.

Therefore the current work mainly focuses on cutting parameter (like cutting speed, laser power, work piece thickness, and assisting gas pressure) to understand the relationships between above said parameters and resulting cutting quality. In this work, the cutting of plastic board, wood, card board, different types of papers, leather, plastic sheets is performed using the laser at different power levels.

Material	Thickness	Cutting Speed	Power	Time require for single pass	Number of passes	Total time required
Paper 1	50	500	500	130	1	130
	50	800	500	62	1	62
	50	1000	500	51	1	51
Paper 2	160	500	500	103	2	206
	160	800	500	59	2	118
	160	1000	500	53	2	106
Paper 3	350	500	500	122	5	613
	350	800	500	61	7	431
	350	1000	500	70	6	420
Plastic sheet	-	800	500	115	2	229
	-	1000	500	58	2	116
	-					
Black Board	-	800	500	72	16	1140
	-	1000	500	62	18	1124
	-					
Card Board	-	800	500	62	12	746
	-	1000	500	70	9	636
	-					
Wood Materials	-	800	500	71	15	1068
	-	1000	500	62	19	1187
	-					





VII. CONCLUSION

- 1) This paper present an overview of recent experimental investigation in laser cutting of various engineering materials concerned with cut quality analysis.
- 2) The objective was to indentify the most common process parameters analysed. So in this way relation between different parameter can be estimated.
- 3) Cost and power effectiveness of the process give wide scope of applications.
- 4) The depth of cut during cutting process is influenced by speed, current, voltage number of pass, number of layer and compressed air.

VIII. REFERENCES

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