

RESEARCH ARTICLE

LASER MACHINING OF BASALT GLASS HYBRID COMPOSITE USING DEMATEL METHOD

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Manuscript Info

Abstract

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*Key words: -*Lamp Current, DEMATEL, Pulse Frequency, Cutting speed, Air Pressure Hybrid composites are materials made of two or more different types of fibers incorporated into a single polymer matrix the year 2019 publication failure analysis in bio composites, fiber-reinforced composites, and hybrid composites. A hybrid composition of basalt and glass layer fabricated and its various mechanical properties after being tested. Glass-fiber composite is a magnificence of fiber-reinforced polymer composites. Hybrid compounds are common ones two or more in the matrix combining different types of fiber products manufactured by various hybrid gave researchers compounds have many definitions. A laser machine is a target material that interacts with a laser beam it is a material removal process done by such a device that uses photon energy processing to the target object thermal or photochemical energy is carried in the form of removing the items directly and by melting evaporation elimination. Commercial, industrial, aeronautical, maritime, and recreational constructions can utilize hybrid composites for their main structural components. It offers a wide range of advantages in the aerospace sector, including strong impact resistance. outstanding fatigue and corrosion resistance, and both. A hybrid composite made of layers of basalt and glass has been created, and after that, its varied mechanical characteristics have been examined. It takes time to precisely machine these composite materials. The mechanical performance of the hybrid composite is decreased by a number of constraints in traditional machining, including fiber pullout, delamination, burr formation, matrix crack development, etc. These issues might result in a poorly machined surface. The decision-making trial and evaluation laboratory (DEMATEL) is regarded as an efficient technique for locating the causal links in a complex system. It focuses on assessing the interdependencies between elements and identifying the crucial ones using a visual structural model. Lamp current (amp), Pulse frequency (Hz), Cutting speed (mm/min), Pulse width (ms), Air pressure (bars). From the result, it is seen that Lamp current got the first rank whereas the Pulse width is having the lowest rank.

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Introduction: -

It is thought that the wear behavior of the hybrid composites with coconut sheath fiber as the outer layer was affected by this physical characteristic. The optical micrographs showed that the composite containing coconut sheath fiber had low wear resistance. It demonstrated the polyester matrix's existence of grooves, wear deformation, and uneven surface patches.

Automobile Composites in many indoor and outdoor applications in the industry use hybrid compounds. Magnesium (Mg) 5xxx - magnesium with aluminium Addition strengthens the solid solution by strengthening it increases and strain hardening ability improves. These alloys are of high strength Non-heat-treatable aluminium alloys containing are, therefore, widely used for structural applications are used. Work hardening or "strain hardening" can be used to strengthen aluminium. This process involves forming the metal at a temperature below its recrystallization temperature, which is usually room temperature. The actual process involves forging, bending, drawing, or rolling the aluminium.

Drilling hybrid aluminum metal matrix composites: -

Drilling tests were performed Computer Numerical Control in Vertical Machining Center (VMC 100). (CNC), ARIX CNC Machine Co. Ltd., in Taiwan, China used to conduct experiments, 6 mm diameter drill with size and its helix angle of 30°, point angle 118° was used. SANDVIK (India), TiN coated carbide and polycrystalline and carbides made of diamond (PCD). Were used. The hardness of the drill material HRC is 72, 80 and 90 respectively. [1] The developed models were validated through confirmation experiments. Details of the confirmatory tests The average values were repeated twice were used. Predicted values test the results are very close, so mixed Developed model To predict responses in drilling mixes appropriate. [2] Machining in surface roughness Effect of parameters, metal removal increasing the rate, surface Reduce hardness, particulate metal matrix Response surface method in changing compounds determined using, using coated carbide drills Drilling hybrid metal matrix To predict thrust force in composites and surface roughness have used the response surface method.[3] showed that soft, Extruded and solutiontreated materials are hard ageing materials that produce Less wear and lower driving forces than however, allow investigated parameters Reduce thrust force by up to 25% per range. Self-lubricated aluminium/ Spin speed, feed rate and alumina/graphite He studied the number of hybrid compounds and did an impact on Area. [4] Although Diamond and diamond-coated tools are useful And the machine is very difficult and expensive, which is a major hindrance to instrumentation. However, in the case of drilling, high-speed steel (HSS) Drills are highly cemented carbide The drills and diamond drills used are more expensive, are widespread, unavailable, [7] The Cutting grade of the Surface chip of drilled hole removes the zone It depends. So, Chip surface by studying the manufacturing process More insight into the factors influencing the outcome Researchers can get During the drilling process, chips examine common characteristics collected the chips. of B4C particles and at the B4C-matrix interface Often shorter in tests due to crack propagation Chips were made. Short and intermittent chips make up a chip that is easy to remove from the drilled surface [8]. Drilling is a very important post-processing process that joins individual drilling processes and Reduces the proper selection of tool material. critical to producing good surface-quality holes [10]. Surface finish is affected by feed rate and It was found that cutting speed was not the cause. Mechanical properties of ceramic particle composites Increasingly, however, this Mac incapacitation causes problems. But the Adding small-sized graphite particles is difficult Aluminum matrix composites can be improved by addition to particles, a solid lubricant such as graphite Addition of oil particles rid reinforcement of tribal traits improves compounds. [11] The drilling technique has its advantages and disadvantages And the laser source is mainly of pulse duration Basically. Drilling speed and grade requirements are selected. For example, the helical drilling technique is usually first to second (fs) (ultra short) to nanosecond (nS) is used in the (short) range, with Laser pulse durations, with short or very short pulses of light Helical drilling is relatively slow, but other drilling methods Produce better quality holes compared to [12]. The main objective of this study WJG laser Drilling is to understand process characteristics. Hole drilling and minute heating damage, exiting the hole at the minimum decrease, at the entrance of the hole Minimum spray, hole circle, hole surface profile, minimum bore taper and higher Quality requirements for drilling are important. speed.[14] The demand for customization is increasing From all over the world At the same time competitors Global competition has This trend driving growth from macro to micro markets is largely due to increasing product variety [15]. The attrition rate was 11%. with SiC MMC Compared, 50% of the SiC MMC aluminium matrix SiC is high in friction due to wear. diamond Irregularly shaped composite particles yield due to friction Increases strength and tensile strength, But SiC elongation decreases particle size fraction increases. [16] an Improved surfactant performance in MWCNT-in-oil lubrication It is fundamental There are four primary sub-factors to tribal characteristics- Mechanisms are responsible for the lubrication of the mechanism A deeper investigation reveals. These are viscosities development, formation of micellar structures; Aluminum hydroxide, iron carbide and a three-layer formulation composed of aluminium and iron

On the surface of the specimens exposed to wear, wear tracks and matrix cracks could also be seen in addition to the grooves and surface patches. However, no fiber breaking, pulling out, or stripping damage to the reinforcing fibers was noted. Laser machining of basalt glass hybrid composite outperformed their equivalents made of separate fibers in terms of wear resistance. The amount of mass loss, the rate of specific wear, and the coefficient of friction against increasing sliding distance were all found to be lower in hybrid composites with sisal in the core and coconut sheath fibers in the outer layer, and vice versa. The optical micrographs of the hybrid composite specimens revealed that they included less porosity or voids than the composite made with coconut sheath fibers, which had a substantially larger void content. A laser machine is a target material that interacts with a laser beam it is a material removal process done by such a device that uses photon energy processing to the target object thermal or photochemical energy is carried in the form of removing the items directly and by melting evaporation elimination. Laser machining has recently been used to remove more material possible to achieve rates subtly unfolded. In this review paper, laser machining of structural ceramics aimed at and complex understanding of the physical nature of phenomena experiments, and calculation in taking emphasis on approaches [1]. Laser machining, micro/nano structuring a new technology for production, in recent years, scalable, one-step strategies and its particular 3-d processing capabilities, excessive through production resolution in almost all kinds it's a wide range of products great for use received attention. The term laser was first coined in 1957 and proposed and induced in radiation refers to light amplification by emission [2].Ultrashort-pulse laser apparatus now in various locations around the world is being developed. Used for laser machining optimum machine for the job, including material a choice of parameters is required. The new technology is laser machine printing. A very flexible process. Ceramics, carbide, and hardened better productivity of steel have better productivity than steel. Laser machining is traditional in die making it offers many advantages over electrodischarge machining [3]. Space and others a mix of occupations in improving the engine materials there is great interest. This paper on s jetting techniques and laser comparison of mechanical technologies focus on research. The gas flow rate was 80 l/min. According to them, this model is more powerful that works well for densities and feed rates as expected, these conditions are less contact to get through the lower cuts conveyance losses are ignored and the cutting process is semi-from print design considered adiabatic [4]. Hybrid compounds are two or more reinforcement composites containing a mixture of fibers a very common hybrid compound carbon-aramid bolstered epoxy is energy and impact-resistant and glass carbon-reinforced epoxy, which combines a sturdy product and offers reasonable prices. Product. So, they are treated with NaOH solution side by side for sisal fibers and hybrid composites by using selected jute fiber to check the fit of the item recommended. So proposed hybrid composite absorbs moisture which is significant. Tested I also found swelling in hybrid composite samples [5]. Hybrid composites have high modulus and low modulus consisting of fibers in alternating positions. Immediately adjacent to the group of broken fibers stress for both types of fibers concentration factors has been evaluated. The method of influence operation and Fourier series representation is accepted. Commonly the matrix uses more than one type of fiber the material in hybrid composites, and single strand composites the stress redistribution problem is more complex than according to the geometric shape of the fiber structures, facilitating intercalation of hybrid compounds can be classified as combined [6]. Hybrid composites with unique weight % fibers had been prepared. 1:1 ratio of roselle and sisal fibers in various fiber lengths are bonded in an unsaturated polyester resin. Fiber and length of roselle and sisal fibers increase while joint strength tensile and flexible properties increased. Natural fiber's moisture absorption properties are positive composite natural fiber hybrid composite produces products with the impact it is very important to do. Experimental effects are theoretical and empirical ones or compared to statistical consequences discovered to be inappropriate agreements [7]. Print the chamber is tightened with bolts refrigerate for 24 at room temperature hours, healing after the method, is prepared the mixture is removed from the mold. Also, an engineer for processing the mixture was used. Fabricated hybrid composite is $250 \times 200 \times 2.15$ mm and has dimension. Natural fiber composites, natural fiber, and fiberglass to overcome the weaknesses of mixed together in one team compounds can be formed, which are elements full of excellent features using, thereby optimizing, a superior but economical combination. Received [8] Natural fibers such as synthetic bonding fibers and electric mirrors. The composition was developed and studied. A hybrid mainly in high humidity environments as an alternative to glass fiber composites intended for engineering applications. Cold press the hybrid mixture made at home using the technique. Water in hybrid mixtures effect of absorption environmental conditions will be examined three at room temperature different, ie distilled water, rainwater, and seawater [9]. This hybrid mixture of more accurate machining is a matter of concern. Currently, at work, basalt glass is a mixed laser of mixed beam drilling, affected by low heat area and max high drill with hole circulation quality related safe machine to predict the zone. Multiple objective and response surface method respectively modeling using genetic algorithms and upgrade [10]. Basalt glass hybrid composite hand-laid has woven basalt and seller of glass fibers compositions tomorrow arihant. Tensile stress for basalt-glass hybrid composites strain bending and flexural stress a strain curve is also provided. Between predicted and experimental values good contact, favorable during laser basal machining for

determining process parameters validates the proposed method. Basalt hybrid composite series synthetic seawater subject to conditions. Some articles are mixed various environmental effects have also been implicated in the compounds. In these studies, the mixt thermo of compounds' mechanical properties were evaluated. Their results are carbon fiber in hybrid composites mixed after introduction the property of the composite showed slowness in degradation [11].

Materials & Methods: -

Lamp current (amp): A closed loop called a CIRCUIT allows charges (current) to flow continuously. A circuit in this instance is made up of a power source (breaker box > wall outlet), two conducting wires (lamp cord), and a miniature light to which the free ends of the wires coming from the power source are connected (socket & bulb). A lamp's wattage measures how much energy or power it uses, while a light source's lumens measure how much light they emit. A typical light-emitting element utilized in a variety of circuits, electric lamps are mostly employed for lighting and signaling functions. The lamp's structure is quite straightforward; it consists of a single filament enclosed by a transparent glass globe cover. A 5- or 6-amp fuse or circuit breaker guards a lighting circuit. With this fuse size, the circuit can support lights with a combined maximum power of 1150 watts (5 amps x 230 volts) or 1380 watts (6 amps x 230 volts). Electric light is different Used in circuits A typical light emitting element is, mainly lighting and marking The construction of the lamp is very simple, it has a thread around it, made of transparent glass A spherical card is provided.

Pulse frequency (Hz): The number of cycles generated across the gap in 1 s is the pulse frequency. The surface polish that may be achieved is finer the higher the frequency. The length of the on-time shortens as the number of cycles per second rises. Short on-times result in smaller craters and very little material removal. A modulation technique called pulse-frequency modulation (PFM) uses just two levels to describe an analog signal (1 and 0). It is comparable to pulse-width modulation (PWM), in which the duty cycle of a square wave is used to encode the amplitude of an analog signal. Pulse frequency Indicates the number of beats per second. If a large number of pulses strike, the workpiece melts more material in a second. Further, a Bull's brain is a surface that will be rough with more deviations.

Cutting speed:

Cutting speed is the surface speed or simply called speed It also works for cutting tools between the surface of the workpiece Speed difference is relative speed. The speed differential (relative velocity) between the cutting tool and the surface of the workpiece it is operating on is known as cutting speed, often known as surface speed or simply speed.

Pulse width:

Pulse width is a unit of energy leading and trailing the pulse of elapsed time between edges is measurement. This measurement is usually used with electrical signals and radar and power supplies widely used in fields. The pulse length or pulse width may be calculated by multiplying the pulse time by the speed of light. the linear portion of a radar pulse's range that it occupies.

Air Pressure:

The air around you has weight, and it squeezes everything it touches. That pressure is called atmospheric pressure or air pressure There are two closely related activities. is called to Earth by gravity Being dragged by the air above it This is the force exerted on the surface. Atmospheric pressure is generally Measured with a barometer.

Method: -

The DEMATEL method is a specific problem, pinup binding work through problems and a hierarchical structure contribute to identifying workable solutions structural modeling techniques, for one reason interrelationships between components of the organization identifying dependencies and basic concept of situational relations can affect and influence of elements causal charting uses direction charts. The DEMATEL system is integrated with emergency management together with manage. In the manner proposed, it is not necessary to defuzzify obscure numbers before using the DEMATEL method [12]. Built on the basic principle of DEMATEL, it executes issues by visualization method analyses, and solves. Modeling this structure approach adopts the form of a driven diagram, which is a causal effect for presenting values of influence between interrelated relationships and factors. By analyzing the visual relationship of conditions between systemic factors, all components are a causal group, and the

effect is divided into groups. It also provides researchers with structure between system components better understanding of the relationship and complexity for troubleshooting computer problems can find ways [13]. The DEMATEL method effectively calculates the consequences between criteria, which efficiently separates the set of complicated elements right into a sender organization and a recipient institution and transforms it right technique to choosing a management gadget between alternate configurations explicit priority weights come from, in addition, the zogp model allows companies to make full use of limited resources for planning to implement optimal management systems [14]. Therefore, decision-makers need to determine obstacles to the legal framework is strong and make sure it is controllable in order to minimize impact or influence barriers. Therefore, derived from the ism and DEMATEL methods the results are somewhat consistent. Integrated ism DEMATEL results for e-waste management constraints determine not only the structure but also the structure of the interactions between these barriers [15]. Accordingly, the preliminary drawback cluster one became about topics including the comparative weights of selection makers in the DEMATEL approach who did now not well bear in mind linking to the team decision-making. Obviously, in a group decision-making hassle, regular decision-makers can always trust their factor of view and count on it to be prevalent via other selection-makers. This way the very last evaluation guides must be close to their judgments, and if the very last assessment effects are near their critiques, the choice maker is willing to simply accept it; otherwise, they may deny it. It is believed that a significant purpose for the aforementioned discrepancies lies in methods based on unstructured comparisons such as DEMATEL [16]. DEMATEL is widely accepted for analyzing the overall relationship between factors and classifying factors into cause-and-effect types. Therefore, this article considers each source as a criterion in decision-making. Based on DEMATEL, the significance and level of significance of each piece of evidence can deal with a mixture DEMATEL method with the source theory for better conclusions. In this article, instead of the comparative criteria provided by the experts in DEMATEL [17]. The corresponding propositions between the bodies of sources are changed. The DEMATEL technique was used as well as creating causal relationships between criteria for evaluating the integrated multiple scale decision making (mcdm) outreach personnel program. Integrates DEMATEL and a new clusterweighted system in which dematel system is a company the reason for the complexity between the criteria is to visualize the structure of relationships it is also used to measure the influence of criteria. Buyukozkan and ozturk can integrate anp and DEMATEL an innovation in terms of technology and have developed an approach, which is for companies to help determine important six sigma projects and logistics specifically prioritize these projects helps to identify companies [18].

| | Lamp current | Pulse frequency | Cutting speed | Pulse width | Air pressure | Sum |
|-----------------|--------------|-----------------|---------------|-------------|--------------|-----|
| Lamp current | 0 | 2 | 4 | 2 | 3 | 11 |
| Pulse frequency | 4 | 0 | 2 | 1 | 2 | 9 |
| Cutting speed | 2 | 1 | 0 | 3 | 2 | 8 |
| Pulse width | 1 | 3 | 2 | 0 | 4 | 10 |
| Air pressure | 2 | 2 | 1 | 2 | 0 | 7 |

Result and Discussion:-

Table 1:- Laser Machining of Basalt Glass Hybrid Composite.

Table 1 shows that DEMATEL Decision making trail and Laser Machining of Basalt Glass Hybrid Composite isLamp current, Pulse frequency, cutting speed, Pulse width, Air pressureusing in the table.

Figure 1 shows that DEMATEL Decision making trail and evaluation laboratory in Laser Machining of Basalt Glass Hybrid Composite isLamp current, Pulse frequency, Cutting speed, Pulse width, and Air pressure.

Table 2 shows that the Normalizing of the direct relation matrix in Lamp current, Pulse frequency, Cutting speed, Pulse width, Air pressure the diagonal value of all the data set is zero.

Figure 2 shows the Normalization of the direct relation matrixit is seen that Pulse frequency is showing the highest value for Lamp current is showing the lowest value.



Figure 1:-Laser Machining of Basalt Glass Hybrid Composite.

|--|

| Normalization of direct relation matrix | | | | | | |
|---|--------------|-----------------|---------------|-------------|--------------|--|
| | Lamp current | Pulse frequency | Cutting speed | Pulse width | Air pressure | |
| Lamp current | 0 | 0.181818182 | 0.36363636 | 0.181818182 | 0.272727273 | |
| Pulse frequency | 0.363636364 | 0 | 0.18181818 | 0.090909091 | 0.181818182 | |
| Cutting speed | 0.181818182 | 0.090909091 | 0 | 0.272727273 | 0.181818182 | |
| Pulse width | 0.090909091 | 0.272727273 | 0.18181818 | 0 | 0.363636364 | |
| Air pressure | 0.181818182 | 0.181818182 | 0.09090909 | 0.181818182 | 0 | |



Figure 2:- Normalization of direct relation matrix.

Cutting speed

Pulse width

Air pressure

0.272727273

0.181818182

0

Air pressure

0.27272727

0.18181818

0.18181818

0.18181818

0

| Calculate the total relation matrix | | | | | |
|-------------------------------------|--------------|-----------------|---------------|-------------|--|
| | Lamp current | Pulse frequency | Cutting speed | Pulse width | |
| Lamp current | 0 | 0.181818182 | 0.363636364 | 0.181818182 | |
| Pulse frequency | 0.272727273 | 0 | 0.181818182 | 0.090909091 | |

0.090909091

0.272727273

0.181818182

 Table 3:-Calculate the Total Relation Matrix

Laser Machining of Basalt Glass Hybrid Composite

0.181818182

0.090909091

0.181818182

Lamp current, Pulse frequency, Cutting speed, Pulse width, Air pressure

Table 4:-T= Y(I-Y)-1, I= Identity matrix.

| Ι | | | | |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 |

0

0.181818182

0.090909091

Table 4 Shows theT= Y(I-Y)-1, I= Identity matrix in Lamp current, Pulse frequency, Cutting speed, Pulse width, and Air pressureis the common Value.

Table 5:-Y Value.

| Y | | | | |
|----------|----------|----------|----------|----------|
| 0 | 0.181818 | 0.363636 | 0.181818 | 0.272727 |
| 0.272727 | 0 | 0.181818 | 0.090909 | 0.181818 |
| 0.181818 | 0.090909 | 0 | 0.272727 | 0.181818 |
| 0.090909 | 0.272727 | 0.181818 | 0 | 0.181818 |
| 0.181818 | 0.181818 | 0.090909 | 0.181818 | 0 |

Table 5 Shows the Y Value in Laser Machining of Basalt Glass Hybrid Composite isLamp current, Pulse frequency, Cutting speed, Pulse width, Air pressure is Calculate the total relation matrix Value and Y Value is the same value.

Table 6:-I-Y Value.

| I-Y | | | | | |
|----------|----------|----------|----------|----------|--|
| 1 | -0.18182 | -0.36364 | -0.18182 | -0.27273 | |
| -0.27273 | 1 | -0.18182 | -0.09091 | -0.18182 | |
| -0.18182 | -0.09091 | 1 | -0.27273 | -0.18182 | |
| -0.09091 | -0.27273 | -0.18182 | 1 | -0.18182 | |
| -0.18182 | -0.18182 | -0.09091 | -0.18182 | 1 | |

Table 6 Shows the I-Y Value in Laser Machining of Basalt Glass Hybrid Composite isLamp current, Pulse frequency, Cutting speed, Pulse width, Air pressuretable 4 T= Y(I-Y)-1, I= Identity matrix and table 5 Y Value Subtraction Value.

| Table 7:- (I-Y)-1 | Value |
|--------------------------|-------|
| (T T7) 1 | |

| (I-Y)-1 | | | | |
|----------|----------|----------|----------|----------|
| 1.610232 | 0.753533 | 0.945449 | 0.78095 | 0.890051 |
| 0.706331 | 1.474562 | 0.692764 | 0.577162 | 0.691634 |
| 0.613624 | 0.561334 | 1.513002 | 0.697287 | 0.671283 |
| 0.555681 | 0.678067 | 0.65065 | 1.459864 | 0.658564 |
| 0.57801 | 0.579423 | 0.553703 | 0.575749 | 1.468344 |

Table 7 shows the (I-Y)-IValue in Laser Machining of Basalt Glass Hybrid Composite isLamp current, Pulse frequency, Cutting speed, Pulse width, and Air pressureTable 6 shows the Minvers shows used.

| | Total Relation matrix (T) | | | | | | |
|----|---------------------------|----------|----------|----------|----------|----------|--|
| | 0.610232 | 0.753533 | 0.945449 | 0.78095 | 0.890051 | 3.980215 | |
| | 0.706331 | 0.474562 | 0.692764 | 0.577162 | 0.691634 | 3.142453 | |
| | 0.613624 | 0.561334 | 0.513002 | 0.697287 | 0.671283 | 3.056529 | |
| | 0.555681 | 0.678067 | 0.65065 | 0.459864 | 0.658564 | 3.002826 | |
| | 0.57801 | 0.579423 | 0.553703 | 0.575749 | 0.468344 | 2.755229 | |
| Ci | 3.063878 | 3.046919 | 3.355568 | 3.091012 | 3.379876 | | |

 Table 8:-Total Relation matrix (T).

Table 8 shows the Total Relation Matrix (T) the direct relation matrix is multiplied by the inverse of the value that the direct relation matrix is subtracted from the identity matrix.





Figure 3. shows the Total Relation Matrix (T) the direct relation matrix is multiplied with the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

Table 9:-Ri& Ci.

| | Ri | Ci |
|-----------------|----------|----------|
| Lamp current | 3.980215 | 3.063878 |
| Pulse frequency | 3.142453 | 3.046919 |
| Cutting speed | 3.056529 | 3.355568 |
| Pulse width | 3.002826 | 3.091012 |
| Air pressure | 2.755229 | 3.379876 |

Table 9 shows the Lamp current Ri= 3.980215, Ci=3.063878, Pulse frequency Ri= 3.142453, Ci=3.046919, Cutting speedRi= 3.056529, Ci=3.355568, Pulse width 3.091012, Air pressure Ri= 2.755229, Ci=3.379876.



Figure 4:- Chart title Ri& Ci.

| | Table 10:-Calculation | of Ri+Ci and Ri-C | Ci To Get The | Cause And Effect. |
|--|-----------------------|-------------------|---------------|-------------------|
|--|-----------------------|-------------------|---------------|-------------------|

| | Ri+Ci | Ri-Ci | Rank | Identity |
|-----------------|----------|----------|------|----------|
| Lamp current | 7.044093 | 0.916337 | 1 | cause |
| Pulse frequency | 6.189373 | 0.095534 | 3 | cause |
| Cutting speed | 6.412097 | -0.29904 | 2 | effect |
| Pulse width | 6.093838 | -0.08819 | 5 | effect |
| Air pressure | 6.135105 | -0.62465 | 4 | effect |

Table 10 shows the Calculation of Ri+Ci and Ri-Ci to Get the Cause and Effect. the final result of this paper the Lamp currentis in 1st rank cause, Pulse frequency is in 3rd rank cause, Cutting speed is in 2nd rank effect, Pulse widthis in 5th rank effect and Air pressure is in 4th rank effect. The final result is done by using the DEMATEL method.



Figure 5:-Rank.

Figure 5. Rank shows the final result of this paper the Lamp currentis in First rank cause, the Pulse frequency is in Third rank cause, the Cutting speed is in Second rank effect, the Pulse widthis in fifth rank effect and the Air pressure is in Fourth rank effect.

| T matrix | | | | |
|----------|----------|----------|----------|----------|
| 0.610232 | 0.753533 | 0.945449 | 0.78095 | 0.890051 |
| 0.706331 | 0.474562 | 0.692764 | 0.577162 | 0.691634 |
| 0.613624 | 0.561334 | 0.513002 | 0.697287 | 0.671283 |
| 0.555681 | 0.678067 | 0.65065 | 0.459864 | 0.658564 |
| 0.57801 | 0.579423 | 0.553703 | 0.575749 | 0.468344 |

| Table | 11:- | Т | matrix. |
|-------|------|---|---------|
|-------|------|---|---------|

Table 11 shows the T Matrix Value calculates the average of the matrix and its threshold value (alpha) Alpha = 0.637490107. If the T matrix value is greater than the threshold value then bolds it.

Conclusion:-

A hybrid combination of anterior and posterior restorations creates, they last longer, anti-abrasion and beautifying. The process of removing material by laser machining involves interactions between the target material and the laser beam. After testing, a hybrid basalt and glass layer composition was created and its different mechanical characteristics were discovered. A class of fiber-reinforced polymer composites includes glass-fiber composites. Hybrid substances are typical one at least two in the matrix combining several fabric kinds of products produced by different an amalgam suggested by researchers there are several ways to define compounds. Target material interacts with a laser beam in a laser machine. Such a gadget removes material via a photon-based technique. Thermal or photochemical energy is used to process the target thing by melting, evaporating, or eliminating the objects directly. The findings of mechanical tests on the manufactured hybrid composite are thought to be superior. It takes time to precisely machine these composite materials. The mechanical performance of the hybrid composite is decreased by several constraints in traditional machining, including fibre pullout, delamination, burr formation, matrix crack development, etc. These issues might result in a poorly machined surface. Due to its non-contact nature and fast output rate, laser machining might be one of the finest alternatives. Composites that include two or more reinforcing fibres are considered hybrid composites. The most popular hybrid composites are glass-carbon reinforced epoxy and carbon-aramid reinforced epoxy, which combines strength and impact resistance (which gives a strong material at a reasonable price). The laser beam will completely cut through the material, leaving a clean, smooth edge, if the laser intensity is strong enough. A fibre laser can be used to perform the laser cutting procedure if the metallic components of the composite are present. The DEMATEL approach is an effective way to collect team knowledge to create a structured model and visualize the causal link between subsystems. Crisp values, nevertheless the murky nature of reality is a reflection enough DEMATEL research, particularly applications of DEMATEL. Based on DEMATEL, it is possible to combine the DEMATEL approach with the source theory to deal with the importance and level of significance of each piece of evidence to draw more accurately. The Lamp current ranks first among the causes of this study, followed by Pulse frequency, third among the causes, Cutting speed, second among the effects, Pulse width, fifth among the effects, and Air pressure, fourth among the effects.

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