Selection of Optimal Specimen In Laser Beam Cutting using PSI

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Abstract- *Laser cutting continues to be the foremost common industrial application of CO2 optical maser systems however presently out there high-energy fiber optical masers appear to be a lovely different to the established CO2 laser sources for many cutting tasks. Sensible expertise has shown that fiber lasers modify considerably raised travel rates within the case of inert-gas fusion cutting. This advantage in achieving higher cutting speeds compared to CO2 optical laser cutting is but a transparent operate of the sheet thickness to be cut. Within the 1st a part of this text, double reasons for this experimental reality square measure derived from a thermodynamical analysis of the method considerately of the precise beam absorption characteristics underneath cutting conditions. After that, within the second half, a quite new optical laser cutting variant, particularly the gas-free remote cutting method that significantly edges from the ray of light quality of Fiber optical laser systems, is bestowed.*

Keywords- Fiber laser cutting, process efficiency, absorption characteristics, gas free remote cutting

I. INTRODUCTION

Laser cutting of metals has become a reliable technology for industrial production. Currently, it's thought of as a possible various to mechanical cutting and blanking because of its flexibility and talent to method variable quantities of sheet components in a {very} terribly short time with very high programmability and minimum quantity of waste. Optical device cutting doesn't want special fixtures or jigs for the work piece as a result of it's a non-contact operation. To boot, it doesn't want costly or similar tools and doesn't manufacture mechanical force which will harm skinny or delicate work items. Optical device cutting have several principles because the same because the typical fusion cutting ways. However the optical device cutting excels in applications requiring high productivity, a high edge quality and minimum waste, because of the quick and precise cutting method.

Stainless steel could be a daily used material and dominantly employed in the optical device cutting trade. Within the previous few years, the fast development of high power fiber lasers provides a lot of economical, sturdy new technologies for materials method.

The development of real time monitoring system could become an important step forward towards fully automated laser cutting. The information obtained from this process could be used as a input for a control system that adapts the parameters

II. LITERATURE REVIEW

The Selection of optimal Specimen in Laser Beam Cutting using PSI (preferential selection index) and MLGFD (multi level general factor design) in Stainless Steel 314 is carried out in fiber laser beam cutting method. The parameters such as Nozzle diameter, Gas pressure, Cutting speed are used as Factors and varied from minimum to maximum values to produce the desired result.

It is proved by testing the Flatness, Roundness, Parallelism, and Surface roughness of the machined material. The advancement in the Laser Beam Cutting process and optimization process of various Authors on this technique is described detail in below.

Many works have mentioned on the optimisation of the cutting parameters of carbonic acid gas optical device on steel. But in (2007) Siti lydiya[1] distinguished that parameters on cutting stainless-steel have not nevertheless mentioned a lot of. so this experimental work discusses on the optimization of optical device cutting parameters on stainless-steel as a result of, stainless-steel is widely applied in industries. Several thicknesses of stainless-steel samples are utilized in this experiment. The parameters studied during this work are focal length, pressure level and cutting speed. Consequently, all the parameters are analyzed to urge the most effective result. In Manchester, School of mechanical engineering U.K.[2] (2007) in lighter material the experiments were performed on as-received 1 mm thickness sheets of EN43 annealed mild steel. Experiments were conducted using a continuous-wave IPG YLR-1000-SM ytterbium single-mode fiber laser. In (2008) BOC[3] steered that to get an ideal machining The cutting gas used is crucial to the cutting result. Element typically yields smart cutting performance in carbon steels and low alloyed steels. However, element reacts with the bottom metal, and also the cut edge is covered with

associate degree compound layer. These area unit the explanations why high-alloy steels area unit being cut with gas additional and additional usually whenever sufficient optical device power is obtainable. In (2008) Ahmed, Y.Nassan[4] conducted study in, associate by experimentation valid model of optical device blanking of squares. samples is developed by ANSYS. The thermal distribution on the cutting edges shows that the most temperature at the leading edge is freelance of optical device power and speed. In (2009) A. Mahrle, E. Beyer[5] discovered that it's anticipated that enhancements of the energy transfer efficiency for fiber optical laser cutting of thicker steel sheets desires a control of the cut front inclination. Initial experiments have demonstrated that such an impact is possible throughout the cutting process if the ray is longways oscillated with oscillation amplitudes equivalent to a multiple of the beam diameter.R.K.Jain[6] (2015) conducted experiment on underwater disassembly of recent equipments and structures because it is a very important application in nuclear facilities and shipping business. This paper presents a study on method improvement throughout periodic Nd:YAG optical laser cutting of thick stainless-steel (AISI SS304) sheets having a thickness within the vary of 4–20 metric linear unit in dry air and underwater atmosphere. optical maser cutting experiments are performed employing a 500W average power long pulse Nd:YAG optical laser system with fiber optic beam delivery. A water protected optical laser cutting nozzle with concentrical burner was specifically developed to make a neighborhood dry cavity round the shaft of light during the cutting.In (2015) M.Sohaib, P.L.Crouse,[7] Studied that variation in kerf breadth presents a more difficult drawback. all-time low variation in kerf width was recorded mistreatment the greenhouse emission optical device, cutting from thin to thick section with the beam facing the flat aspect of the workpiece; the thick section displaying a ~30µm wider kerf. The worst case was obtained with the Nd:YAG, cutting from skinny to thick, with the beam facing the stepped aspect. Here the skinny section is wider by ~500 µm.In (2016) D.B.Nigade, V.S.Yadhav[8] concluded that gas pressure, cutting power and nozzle diameter are the significant parameters which affecting the surface roughness. The observation made that nozzle diameter and cutting speed are the significant parameters affecting on the material removal rate. In (2017) Dr.G.Jayaprakash[9] presented an overview of the recent experimental investigations in laser cutting of various engineering materials concerned with cut quality like surface roughness, HAZ and kerf width and identifies the most common process parameters and cut quality characteristics. Drupal.j.kodadiya[10] in (2018) projected a method within which, the optical laser light-weight is targeted on piece of work material and it'll soften owing to high heat. Laser cutting, being a non-contact method and it does not involve any mechanical cutting forces and gear wear. The soften is then blown out of the kerf dimension by assist gas [1-2]. In metal cutting, the optical maser cutting quality depends on optical laser power, cutting speed, pressure level, beam diameter, beam incident angle, stand-off distance, pulse frequency and focus positions.In 2019 Nithin.N.gotkhindar[11] The Taguchi technique with L18 array is employed with success to conduct experiments. S/N quantitative relation analysis suggests the optimum setting of optical laser cutting parameters for surface roughness at nozzle diameter 1.2 mm, cutting speed 2300 mm/min, cutting power 1900 watt and pressure 0.14 MPa. For material removal rate technique offers optimum settings as nozzle diameter 2mm cutting speed 2300 mm/min, cutting power 1800 watt and pressure 0.12 MPa.In (2019) B.S.Wardhana, K.S.Anam[12] observed that within the optical laser cutting method, the pressure functions because the gas thrust force, in order that it flows towards the cutting purpose and there's a reaction with the fabric that has been discontinue. Higher pressure permits gas provide once cutting is best in order that the fabric evaporation method is best.In (2019) Huiming Ding[13] illustrated that Similar characteristics of coldness stress-strain curves square measure found in part composition, martensitic transformation and curve shapes. Thus, same low-temperature material model are often used for different primary solid solution untarnished steels The empirical relations between low-temperature material model parameters and mechanical properties of square measure founded by analyzing on 351 sets of tensile check knowledge of various austenitic untarnished steels. Rajesh attri[14] in (2015) conducted experiments in various process at design stage and observed that in comparison with other MCDM methods like AHP, ANP, TOPSIS, VIKOR, GTA, WEDBA, MOORA, PROMETHEE, GRA etc., the proposed PSI method is very simple to understand and easy to implement. In a literature review on these existing MCDM methods, it is revealed that it is necessary to assign the relative importance between attributes or weights of attributes are required. Miloš Madića, Jurgita Antucheviciene[15] (2016) illustrated that The dioxide optical device cutting experiment was dole out mistreatment By Vention 3015 dioxide optical device cutting machine. The piece of work material was AISI 304 stainless steel and also the sheet thickness was three millimetre. chemical element with purity of 99.95% was used as assist gas in experimentation and it had been supplied via cone-shaped nozzle with a pair of millimetre diameter. The light beam was focused mistreatment lens with focal distance of 127 millimetre. The experiment was performed to produce a solid knowledge-base about the influence of the optical device cutting parameters on the cut quality characteristics (kerf dimension, surface roughness and dimension of HAZ) and material removal rate (MRR). The measurements of cut edge surface in terms of average surface roughness (Ra) were dole

out with Surftest SJ-301 profilometer. Kerf dimension (w) and dimension of HAZ values were obtained mistreatment optical.In (2008) Derek Bingham[16] factorial and fractional factorial designs with randomization restrictions are frequently used in industrial applications. Here, we have developed a general framework for constructing and evaluating such experiment plans so as to search for a "good" design. Hence PSI method is best for the calculation analysis and MLGFD gives good result at software calculation.

III. PROBLEM IDENTIFICATION

The Stainless steel grade 314 has excellent high-temperature resistance characteristics among the chromium-nickel steels series .Out of many non conventional processes the Laser cutting presents certain advantages over plasma cutting as this process is more precise and uses less energy when cutting steel and Aluminium sheets Laser cutting technology also enables us to cut complex shapes without the need for tooling and at a similar or faster speed than other cutting methods. The need for testing such as parallelism, flatness, surface roughness, Roundness is tested because Whenever two surfaces or features need to work in sync with each other and constant distance must be maintained, parallelism is effective. Whenever you have a part that must always fit nicely between two planes that need to reference each other, it comes in handy, The flatness is used to give a surface an even amount of wear or for sealing properly with a mating part. Rough surfaces generally wear more rapidly and have greater friction coefficients than smooth surfaces. Typically, Similarly roughness is a dependable predictor of mechanical part performance, as irregularities tend to form nucleation and breaks. Roundness the measurement is an extremely important assessment. For example, a rotational bearing whose components are not accurately round will tend to be noisy and is likely to fail prematurely. Hence The optimization of stainless steel 314 in laser beam cutting is tested with the parameters

IV. RESEARCH SCOPE

The process involved studies the parameters such as nozzle diameter, gas pressure, cutting speed The focused laser beam is directed at the material, which then either melts, burns, vaporizes away, or is blown away by a jet of gas leaving an edge with a high-quality surface finish. This paper reviews the analysis work administrated thus far within the space of Laser beam cutting of various materials and shapes. It reports regarding the experimental and theoretical studies of Laser beam cutting to enhance the method performance. Many modelling and improvement techniques for the determination of optimum shaft cutting condition are critically examined. The last a part of this paper discusses the Laser beam cutting developments and descriptions the trend for future analysis.

V. CONCLUSION

Based on literature survey, the authors concluded the points listed below.The conclusions that may be drawn from Fiber laser cutting on 314 Stainless steel sorts with variations in cutting parameters area unit as follows Gas pressure features a wide influence on the fabric hardness properties ever-changing. Cutting speed affects additional the surface quality created. (In this study surface quality was represented by roughness values) The work piece thickness has a control on the surface quality produced the thicker the work piece, the cutting surface quality decreases.

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