THINK INDIA JOURNAL

ISSN: 0971-1260
Vol-22-Issue-10-November-2019

Analysis And Machining Parametric Optimization Of Hot Air Abrasive Jet Machining On Pmma By Help Of Taguchi Method & MCDM-TOPSIS

[1]K.CHAITANYA KUMAR, [2]Y.RAMESWARA REDDY, [3]S RAJENDRA PRASAD.

[1]M.Tech Scholar, Department of Mechanical Engineering , JNTUA College of Engineering, Pulivendula, Andhra Pradesh, India
[2]Assistant Professor, Department of Mechanical Engineering , JNTUA College of Engineering, Pulivendula, Andhra Pradesh, India[3]Reserch scholar JNTUA, Department of Mechanical Engineering, Anantapur, Andhra Pradesh, India

ABSTRACT

The contemporary paper centred on the optimization of HAJM in machining of PMMA fabric by means of using of MCDM- TOPSIS method, in this manner orthogonal array l_9 Taguchi experimental layout is used through thinking about the technique of machining parameters such as Pressure of provider gas, SOD, Temperature of air service gasoline , Abrasive Size and type , to function a HAJM experiment for viewed responses such as surface roughness(RA) ,material removal rate (MRR)

The Poly(methyl methacrylate) (PMMA), also regarded as acrylic glass, acrylic material, or plexiglass as properly as by using the change names Crylux, Plexiglas, Acrylate, Lucite .PMMA it is a obvious thermoplastics.the chemical formula of PMMA is $(C_5O_2H_8)_n$ it has good properties to such as light weight ,92%transferent visible light effect within 3mm of thick material, good strength to compare other polystyrene. it's mostly useful in this areas such as hospitals, automobile, aerospace, defence, aquarium, window panels

Key words: Hot Air Abrasives Jet Machining-HAJM,PMMA, Taguchi analysis,MCDM-TOPSIS method .

INTRODUCTION

HOT air abrasive jet machining(HAJM) is one type of non-traditional machining process. such as abrasive jet machiningprocess(AJM),ultrasonicmachining(USM),magnet ic abrasive finishing(MAF),laser machining ,chemical machining, electrochemical machining,(ECM), abrasive flow machining (AFM),ION beam machining (IBM),electric discharge machining (EBM),abrasive water jet machining (AWJM), the hot air abrasive jet machining consists more degree of adjustability. HAJM is applied many purpose of operation like drilling, cleaning and etching, hence it is mostly used for machining of glass , ceramics, composite, electrical optical, metamaterials, and plastics.

The industrial manufactures are always trying to reduce cost of production and timeat the same time increase the high production rate.it will be provide the good quality of products and accuracy of machining, there is required to the processparameters of machine in a methodical way the get good characteristics and short extreme response by help of practical methods and mathematicalmodels. MCDM-TOPSIS similarity approach method is mostly suitable for solve a grooving and cutting problem .such as AJM,HAJM,WAJM,WJM, with a less number of trays compared with a other factorial models and it also applicable for WEDM (K.Anand babu 2017) reported that MCDM-TOPSIS method can also be applied for all composited.

The nearer to adopted by design of practical experiment through the MCDM-TOPSIS similarity approach method very useful getting so good solution for optimization problems in production process.

The surface roughness(RA)andmaterial removal rate(MRR) are most essential characteristic in machining on steels, aluminium alloys, and Poly(methyl methacrylate) (PMMA) ,the another name of Poly(methyl methacrylate) (PMMA) is also called as acrylic Glass material or plexiglass as well as by the trade names Crylux, , Acrylite,Plexiglas Lucite, the mostly quality of PMMA sheets are produced by cell casting process.the chemical formula of PMMA is $(C_5O_2H_8)_n$. The density of PMMA stars from 1.17 to 1.20 g/cm^3(as for Eshwar pawar 2016), it is a half of below glass material and the melting point of PMMA range between (160/320 f,433K). the PMMA material is very light weight and more strong material .the acrylic material can be transmits up to 92% visible source of light effects with in 3mm of thickness. The environmental stability of acrylic lass is better as compared to polyethylene and polystyrene. the material was mostly applicable for outdoors , Automotive and Transportation, Electronics, aquarium, Medical and Healthcare, Furniture and Architecture and Construction.

LITERATURE SURVEY

INTRODUCTION

Surface roughnessandMaterial removal rate have been extremely basic factor forecast the exhibition of a sight-seeing abrasive fly machining process. the significance of surface roughness is primarily confirmed to this smoothness of a surface on the workpiece. the title of MRR is representing the aggregate of material removal rate got in the working the machining condition. The HAJM is

ISSN: 0971-1260
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generally useful in aviation, car, cleaning of material, creation of organization logos, electronic boards, metal cutting, aviation parts, applications, where the quality is significant job is involved. The quantity of research work has been finished by this procedure, a portion of the scientists have tried to advance the machining parameters on HAJM, the way to possess the surface unpleasantness valve and consequently writing auditsdid to know how the procedure parameters are improved**.**

non-conventional machining process S.Rajendra Prasad, K.Ravindranath and M.L.S. Devakumar [7] (2018) Considered abrasive jet machining method of Nickel 233 alloy, it entails the in contrast with multi-objective optimization on the Weighted Aggregated Sum Product Assessment (WASPAS) and ratio evaluation (MOORA) to analyze the one of a kind responses i.e fabric removal rate(MRR), surface roughness (Ra) and taper perspective (Ta).es

S.Rajendra Prasad, K.Ravindranath and M.L.S. Devakumar [8] (2016) This research concluded that AJM parameters, like Nozzle size, pressure and shape of nozzle, the abrasive energy flow rate can be effect the output responses.

P.Pavan Kumar, Y. Rameswara Reddy, S.Rajendra Prasad (2017) This Paper Was Considered Ajm Process Of NimonicAlloy75 it could be considered the input parameters of Ajm like pressure, stand off distance and nozzle diameter, it be concluded that material removal rate of machining at the particular bar of pressure and surface roughness by the help of GRA method.

N. Jagannatha, S.S. Hiremath, and K. Sadashivappa, In this paper, an strive has been made to use hot air in AJM. Modified Taguchi robust layout evaluation is employed to find outs the most useful mixture of procedure parameters. The Analysis Of difference (ANOVA) is also used to discover the most important factor.

N. Jagannatha, s. Hiremath somashekhar, k. Sadashivappa, and k. V. Arun , this article is attempt has to been made mix abrasive particles and hot air to create an abrasive warm air jet glide on a workpiece. The ajm is can be useful to operate the operations like as drilling, grooving, cutting and micro ending on the glass sheets.it is initiate that fabric elimination fee increases as the temperature of service gasoline are increased. The ultimate conclusion of situated the roughness of the machined floor is reduced with the aid of increasing temperature of carrier media.

Meet R. Vadgama, Kaustubh S. Gaikwad, Harshil K. Upadhyay And Siddharajsinh G. Gohil . This Article Was Justified That The MRR Is Increases With Increasing Of Carrier Gas Pressure And Decreasing Of Glass Thickness And Stand Of Distance.

1D V Srikanth, 2Dr. M. Sreenivasa Rao The essay provides an full-size assessment of the current kingdom of research and improvement on the abrasive jet machining process. Further objection and scope of future improvement in abrasive jet machining are also projected. This review paper will useful for researchers, policymakers widely and manufacturers.

Sudesh Garg Ravi Kumar Goyal The principle target of current work is to be upgrade machining conditions (Cutting rate, feed, scoring, the profundity of opening) parameters for required least Surface Roughness(ra) in the boring of AISI H11 by utilizing Face Cantered Design. Investigations were led dependent on the structure of trials (DOE) and pursued by an improvement of the outcomes utilizing Analysis of Difference (ANOVA) to discover the base surface harshness.

K. Anand Babu1, P. Venkataramaiah1, and P. Dileep2 The contemporary paper focal factor is the machining optimization of WEDM in the machining process of (Al6061/2%SiC/3µm) Aluminium Metal Matrix composite by the assist of AHP-DENG'S Method. In this process. Usually, the pleasant machining COUNTER is GATHERED through THE solving machining system parameters with optimization technic.

Madhu.S.This paper was demonstrated the nozzle Efficiency of AJM strategy is completely relying upon spout wear and spout wear is depending on more noteworthy methodology parameter and geometrical parameters.

Eshwar Pawar The present paper says that what is acrylic material and different employments of acrylic, use of acrylic later on innovation and so forth attainable regions in which acrylic can play as a valuable decision are likewise secured. As we are living in the territory of innovation and modernization the creator in this examination paper has attempted to concentrate on the upsides of elective materials in the different fields of innovation for flourishing and development.

Bhaskar Chandra, Jagtar Singh This journal intends different results of experiments have been conducted by changing pressure, nozzle tip distance on different thickness of glass sheets. The outcome of their process parameters on the material removal rate (MRR), top surface diameter and bottom surface diameter of hole gather were measured and plotted.

Experimentation

The schematic flow chart 1 of a test set up is showed up in Figure1. It contains conservative Abrasive chamber, the Heating chamber with the controller, Mixing head, and Nozzle. A bit of wind ebbs and flows through the harsh chamber and the reinforcing of grinding particles happen due to the weight differentiate in the unpleasant chamber and standard stream. Harsh particles are mixed with air and a short time later they go into the mixing head where the touring is mixed with abrasives and a while later experienced the spout as showed up in Figure 2. The unpleasant hot stream is available at the tip of spout striking on the target. The movement of unpleasant is compelled by a valve underneath the chamber. The spouts are for the most part included Tungsten carbide material of hardness 50-60 HRC. As the Tungsten carbide material is of astounding

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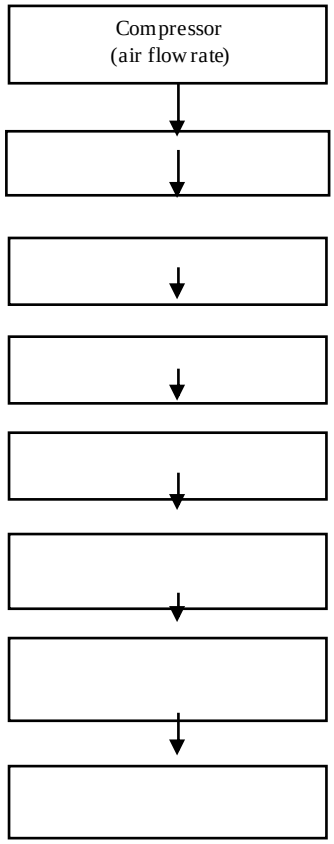
cost, in this assessment work, The temperature of the air at the exit of the spout is evaluated using sensors.

Figure 1: Hot air abrasive jet machine



Flow chart 1 : working process of HAJM for PMMA

Table 1 :Nomenclature of machining unit and their specification for PMMA

Nomenclature	Specification
Sample Material	PMMA
Thickness Of Material	3mm
Nozzle Material	Tungsten Carbide
Size Of Work Piece	30x30mm
Nozzle Diameter	2,3,4
Abrasive type	Aluminium Oxidised
Abrasive size in microns	60,80,100
Pressure in bar	5,6,7
SOD in mm	4,5,6
Temperature Of Air	40,50,60
No Of Experiment	9
Chemical formula	$(C_5O_2H_8)_n$

The Experiment setup as consists of some major components

Compressor: The air blower are mechanical and pneumatic gadget .when air is the packed its under strain more prominent than that of the barometrical weight (1.0325bar or 101.325 kpa) and its especially endeavours to come back to its typical state.

Fig 3 . Air compressor

Nozzle: The hot air abrasive mixer is passed through the nozzle .it converts pneumatic energy in to kinetic energy thus high velocity abrasive jet is obtained.

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Fig 4. Nozzle

Heat exchanger: A warmth exchanger is a structure used to move heat between at any rate two fluids or gas. Warmth exchangers are used in both cooling and warming structures. The fluids may be secluded by a solid divider to envision mixing or they may be in direct contact

Fig.5.heat exchanger

Mixing chamber: The element of the mixing chamber directly affects the mixing impact of abrasive and air jet. Huge estimated chambers can improve the mixing impact of abrasive and air jet, while expanding the obstruction of the air jet.

Fig .6 Mixing chamber

Pressure gauge : The pressure gauge is used to measure the and display the pressure in an particular unit of area. the another name of pressure gauge is vacuum gauge ,pressure meter.

Fig. 7 . Pressure gauge

Working chamber : It is a closed working chamber.It used to avoid pollution and distabens from environment the work piece is placed on the fixture in this chamber.

Fig.8 working chamber

Infrared Thermometer MTX-4: Another title of the infrared thermometer is called as laser thermometers as a laser is used to assist factor the thermometer, or non-contact thermometers or temperature weapons, to delineate the contraption's capacity to evaluate temperature from a division. By understanding the percentage of infrared essentialness transmitted by using the thing and its emissivity, the article's temperature can each and every now and again be settled interior a specific extent of its actual temperature.

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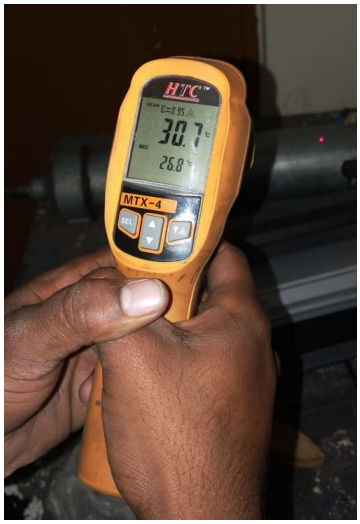

Fig 9 . Infrared Thermometer MTX-4

Experimentation set up

In the existing desk work, PMMA used to be utilized as the work material. The fabulous dimension of example used to be used for drilling forms. The examples have been washed and weighed earlier than machining. The maskants were caught on the outdoor of example to impenetrable the un-machined some portion of work material. The fabric utilized for the maskants have been plastics, ceramics, steels, aluminium alloys, nickel alloys and PMMA materials as they oppose the excessive temperature of a hard sight-seeing jet. After the test, the examples had been cleaned with pressurized air and the remaining weight used to be estimated using a computerized digital parity (GOLD SCALES (0.01 g - 3kg) with dreams of 0.01mg. Four estimations for each instance were taken and the normal worth was the closing perusing. The weight discount per unit time for each and every example is decided and viewed as fabric evacuation rate. Additionally, the unpleasantness of machined part used to be estimated utilizing a surface harshness analyser Taylor Hobson Talysurf 10 surface roughness checking machine, The regular Roughness esteem Ra of the machined phase was once recorded at three unique areas and the imply worth used to be viewed as an unpleasantness of surface.

TAGUCHI ANALYSIS

It was uncovered by Dr. Genichi Taguchi of japan. Taguchi configuration is a measurable technique. This is an extreme parameter plan, for planning preliminaries to assess how disparate parameters bother the mean and difference of a method introduction qualities. It is basically merging on reducing qualification and affectability to commotion. It offers a viable technique for scheming items and strategy that runs effectively, consistently and ideal completed a variety of circumstances. These methodologies include two, three, four, five and blended level partial factorial structures. To choose which viewpoints most noteworthy bother item magnificence, it allows just the assemblage of the basic information henceforth legitimate time and means. Taguchi gives symmetrical exhibit plan which diminishes the experimentation trails. The investigational information are dissected in the Taguchi technique and to disclosure the best reaction underneath ideal state. It is utilized for speculating the single factor interest furthermore their cooperation in the movement reaction. It makes and examination the principle impact plot and cooperation plot for sign to clamour proportion, standard deviations, and means. It additionally produces leftover plot on histogram, ordinary plot, and lingering versus request, remaining versus fits.

The manage elements viewed for this study are pressure, sod, two abrasive size, air temperature. All elements are considered as three ranges each. According to the Taguchi orthogonal array format L9, combined orthogonal array was used to operate the HAJM experimentation. Table 2 the influential factors and their ranges and determine 10 exhibit the HAJM workpiece after warm air abrasive jet machining.

Table 2 : Levels of Input Parameters for PMMA

s.no	factors	Units of factors	levels		
			Level 1	Level 2	Level 3
A	Pressure of air	bar	5	6	7
B	SOD	MM	9	7	5
C	Abrasive size	microns	60	80	100
D	Air Temperature	Degree Celsius	30	50	40

Figure : 10PMMA specimen after HAJM

ANOVA

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The measurable programming minitab17 with a scientific instrument of ANOVA is utilized to figure out which parameter essentially influences the exhibition qualities .the consequences of ANOVA for the single-reaction S/N proportion MRR and RA appear in table3 and table 4

Table 3: General Linear Model: MRR versus Air pressure, SOD, Ab size, Temperature
Results of ANOVA for MRR

Source	DF	Seg SS	Adj ss	Adjms	Contribution
Pressure	2	6.043	6.043	3.021	35.31%
SOD	2	3.992	3.992	1.996	23.33%
Ab size	2	0.596	0.596	0.2983	3.49%
Air temperature	2	6.481	6.481	3.240	37.87%
total	8	17.11			100%

Table 4: General Linear Model: SR versus Air pressure, SOD, Ab size, Temperature
Results of ANOVA for Ra

It tends to be seen the least demanding commitment is air temperature has been done of 37.87% for MRR and 54.53% for Ra. The unwinding of the parameters has less responsibilities. It is obvious that air temperature is one of the gigantic variables that have more effect than some different components on MRR and Ra regards.

Optimization of process parameters using MCDM-TOPSIS based method

The MCDM-TOPSIS likeness based Method is a multicriteria decision making approach gotten by coordinating the AHP with Deng's(TOPSIS) system. In Deng's similitude approach, weightages are required to streamline or to positioning the best procedure parameters of HAJM. Thus the required weightages were acquired utilizing Analytic Hierarchy Process (AHP) approach which is created by Saaty, T., L. (1990). The principle advantage with AHP over different strategies is that AHP is intended to fuse unmistakable just as non-substantial factors particularly where the emotional decisions of various people establish a significant piece of the choice procedure .

Stage 1: Make an assessment framework comprising of m options and n criteria, with the convergence an every option and criteria given as $X_{ij.}$

Stage 2: The vector matrix $(x_{ij})_{mxn}$ is the normalize vector matrix.

$\bar{x}_{ij}=\frac{xij}{\sqrt{\sum_{j=1}^{n} x_{ij}^2}}$ Where is ….

Step 3: Calculate the weighted normalised decision matrix.

$r_{ij}=\bar{x}_{ij}.w_{ij}$ where w = weightages of each sample,i=1,2,3,…..m, j=1,2,3……n

Step 4 : Calculate the ideal best value and idealworst value for non-beneficial criteria

First there a formula for calculating the Euclidean distance from idle best value and ideal worst value

Euclidean distance for Ideal best $s_i^+ =[\sum_{j=1}^{m}(v_{ij}-v_j^+)^2]^{1/2}$

Euclidean distance for Ideal worst $s_i^- =[\sum_{j=1}^{m}(v_{ij}-v_j^-)^2]^{1\backslash 2}$

v_j^+ =indicates the ideal beat value

v_j^- = indicates the ideal worst value

Step 5 : Calculate the performance score is this the formula for performance scare. The performance scare it is denoted by (p_i).

Source	DF	Seg SS	Adj SS	Adj MS	Contribution
Pressure	2	0.424	0.424	0.212	2.65%
SOD	2	0.087	0.087	0.043	0.54%
Ab size	2	6.786	6.786	3.393	42.28%
Air temperature	2	8.754	8.754	4.377	54.53%
total	8	16.053			100%

$P_i=\frac{s_i^-}{(s_i^+ +s_i^-)}$

Step 6 : Based on the performance score we can rank the alternatives.

Results Discussion

The end HAJM limits ,pressure, SOD ,Abrasive size ,and air temperature is determined by ANOVA four emphasis for ever of two councils were done of variable spout breadth consequently as to amount MRR, Ra and signal to noise ratio is assessed by the Minitab programming.

Taguchi Analysis: MRR versus pressure, SOD, Ab size, temp

ISSN: 0971-1260
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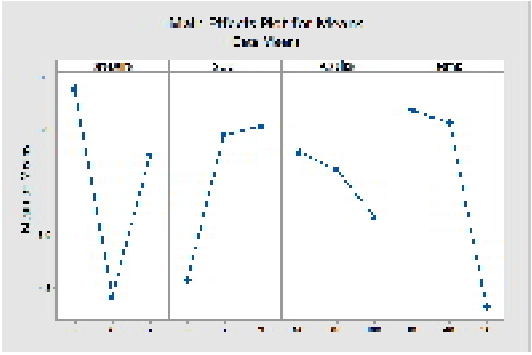

Fig.11Main Effects Plot for Means For MRR

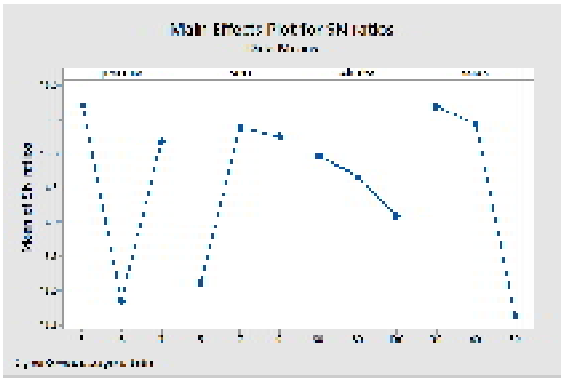

Fig.12Main Effects Plot for SN ratios for MRR

In figure 11 is demonstrates primary impact plot for SN proportions and means, the chart is plotted among mean Of MRR and a few parameters these two diagrams are shown impact of a few factors on mean of S/N proportions and mean of materials end rate plotted to exploitation the machining impact acquired.it is seen from the plot show comparative pattern as uncovered by plot of mean of MRR. This helper approves the impact and result of parameters.

Table 5:Response table for Signal to Noise Ratios

Larger is better

Level	pressure	SOD	Ab size	Temp
1	15.71	13.12	14.96	15.68
2	12.85	15.37	14.67	15.42
3	15.17	15.24	14.09	12.63
Delta	2.86	2.24	0.87	3.05
Rank	2	3	4	1

Table 6: Response table for Means

Level	pressure	SOD	Ab size	Temp
1	6.390	4.583	5.783	6.184
2	4.424	5.953	5.617	6.062
3	5.758	6.035	5.173	4.326
Delta	1.966	1.452	0.610	1.858
Rank	1	3	4	2

Table 7: .Results after HAJM at Various Responses

S.NO	MRR	SR	Normalized MRR	Normalized SR	Weighted Normalized MRR	Weighted normalized SR	Euclidean Best	Euclidean Worst	Performance score	Rank
1	7.82	1.87	0.4566	0.1677	**0.345**	**0.04195**	0.03038	0.01053	0.2573	6
2	7.45	3.0236	0.4351	0.2711	0.326	0.06777	0.02582	0.006149	0.1923	8
3	3.91	6.4336	0.2283	0.5785	0.1712	**0.1446**	0.1495	0.01876	0.1114	9
4	3.83	4.199	0.2237	0.3765	**0.1677**	0.09412	0.00275	0.03292	0.9294	1
5	5.162	3.5953	0.3015	0.3224	0.2261	0.0806	0.00491	0.01753	0.2185	7
6	4.286	2.0043	0.25	0.1802	0.1875	0.04505	0.02219	0.03378	0.6035	3
7	6.456	3.943	0.377	0.3545	0.2827	0.08862	0.01147	0.006646	0.3568	4
8	5.24	3.906	0.3060	0.3503	0.22295	0.08757	0.01452	0.01591	0.2603	5
9	5.57	2.246	0.3253	0.2016	0.2439	0.05065	0.005882	0.01871	0.7787	2

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Taguchi Analysis: SR versus pressure, SOD, Ab size, temp

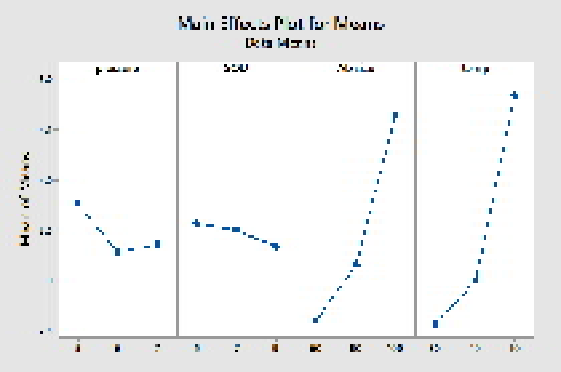

Fig.13 Main Effects Plot for Means for Ra

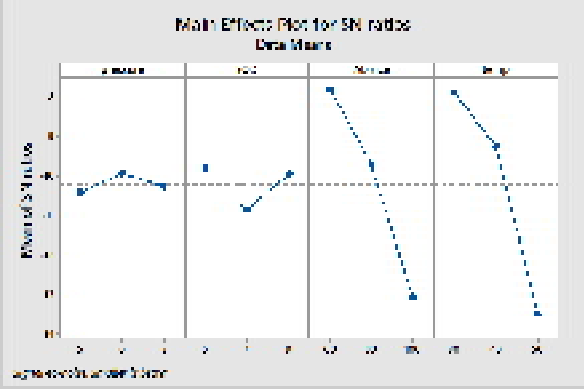

Fig. 14 Main Effects Plot for SN ratios for Ra

In Figure 13 and 14 the charts are plotted among mean of Surface roughness and different parameters. What's more, Figures are shows impact of divergent variables continuing the mean of S/N proportion of material reasoning rate plotted to build up the machining results achieved. It is identified from the plot shows a turn around the pattern as shown by a plot of the mean of Surface harshness. Turn around tendency is owed to a component that reaction for the sign to commotion proportions is locked in as "Smaller is Better". This extra approves the assets and aftereffects of elements.

Table 7: Response table for Signal to Noise Ratios

Smaller is better

Level	pressure	SOD	Ab size	Temp
1	-10.405	-9.789	-7.817	-7.854
2	-9.926	-10.850	-9.692	-9.239
3	-10.248	-9.939	-13.069	-13.484
Delta	0.479	1.062	5.252	5.630
Rank	4	3	2	1

Table 8: Response table for Means

Level	pressure	SOD	Ab size	Temp
1	3.775	3.571	2.603	2.569
2	3.279	3.507	3.154	3.002
3	3.361	3.337	4.658	4.844
Delta	0.496	0.234	2.055	2.275
Rank	3	4	2	1

Conclusion

This present paper speaks to strategy, for example, MCDM-TOPSIS closeness based drawn closer for enhancement the HAJM procedure machining parameters to get an achievable or best reactions on PMMA and the accompanying end have been drawn:

i. Through ANOVA, the degree of responsibility to the hot air temperature is more when diverged from various parameters. In this way, the air temperature is the most significant factor for the touring grating fly machining for minimization of the unpleasantness of machined surface and extension of MRR.

ii. MCDM-TOPSIS Similarity method based method is most useful technique method in HAJM of PAMMA

iii. The parameters Pressure, SOD, Ab Size and Air Temperature and their collaborations, influence the deburring procedure. At lower MR, the deburring time increments with the showdown separation. On account of higher MR, the deburring time at firstdiminishes and on arriving at an ideal worth it increments with the SOD

ACKNOWLEDGMENT

The creators, therefore, thank the creators of the underneath referenced references for their huge duty which engaged us to make this connection

REFERENCES:

1. P MUNI PAVAN KUMAR REDDY & Y RAMESWARA REDDY "Experimental Investigation of Machining Parameter for AJM using Nismonic Alloy 75" (IJTIMES), August-2018, (126-135).

ISSN: 0971-1260
Vol-22-Issue-10-November-2019

2. N. Jagannatha, S.S. Hiremath, "ANALYSIS AND PARAMETRIC OPTIMIZATION OF ABRASIVE HOT AIR JET MACHINING FOR GLASS USING TAGUCHI METHOD AND UTILITY CONCEPT" (IJMME),January 2012,(9-15).

3. N.Jagannatha, S. Hiremath Somashekhar, "MACHINING OF SODA LIME GLASS USING ABRASIVE HOT AIR JET: AN EXPERIMENTAL STUDY" Machining Science and Technology • July 2012,(459-472).

4. A. El-Domiaty, H. M. Abd El-Hafez, and M. A. Shaker, "Drilling of Glass Sheets by Abrasive Jet Machining" World Academy of Science, Engineering and Technology International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering Vol:3, No:8, 2009,(872-8

5. Ahmed Nassef1, Ahmed Elkaseer1,2, El Shimaa Abdelnasser, "Abrasive jet drilling of glass sheets: Effect and optimisation of process parameters on kerf tape" Advances in Mechanical Engineering 2018, Vol. 10(1) 1–10.

6. V Srikanth, M. Sreenivasa Ra, "Abrasive Jet Machining- Research Review" International Journal of Advanced Engineering Technologizing J Adv Eng. Tech/Vol. V/Issue II/April-June,2014/18-24.

7. K. Anand Babu1*, P. Venkataramaiah1, and P. Dileep2, "AHP-DENG'S Similarity Based Optimization of WEDM Process Parameters of Al/SiCp Composite" Columbia International Publishing American Journal of Materials Science and Technology (2017) Vol. 6 No. 1 pp. 1-14

8. Siva prasad PV and noorul Haq,"an entropy-deng's similarity-based technique for modelling optimization of process variables for laser micro drilling alloy x"(jsand ir).aprill-2019 pp(223-230).

9. Madhu.S, "Nozzle Design And Material In Abrasive Jet Machining Process-A Review" International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 10 No.33 (2015),(25526-25533).

10. Eshwar Pawar, "A Review Article on Acrylic PMMA" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 13, Issue 2 Ver. I (Mar. - Apr. 2016), PP 01-04

11. Bhaskar Chandra&, Jagtar Singh, A Study of effect of Process Parameters of Abrasive jet machining, (IJEST),(504-513)

12. Sudesh Garg, Ravi Kumar Goyal," A Study of Surface Roughness in Drilling of AISI H11 Die Steel using Face Cantered Design" IJIRST, May 2015,(464-474).

13. Bhaskar Chandra Kandpal1* Naveen Kumar2 Rahul Kuma, "MACHINING OF GLASS AND CERAMIC WITH ALUMINA AND SILICON CARBIDE IN ABRASIVE JET

14. MACHININ" IJAET/Vol.II/ Issue IV/October-December, 2011/251-256.

15. Varun R*, Dr. T S Nanjundeswaraswamy**"A Literature Review on Parameters Influencing Abrasive Jet Machining and Abrasive Water Jet Machining" Journal of Engineering Research and Application. ISSN : 2248-9622 Vol. 9,Issue 1 (Series -I) Jan 2019, pp 24-29

16. Ahmad Jafarnejad Chaghooshi, Hossein Janatifar and Maedeh Dehghan. (2014). An Application of AHP and Similarity-Based Approach to Personnel Selection. International Journal of Business Management and Economics, 1(1), pp. 24-32.

