International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 01, January-2019

HYBRID MACHINING (A COMBINED APPROACH OF ABRASIVE JET MACHININIG AND MAGNETO FINISHING)

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Abstract: In this paper, we will discuss the effect of hybridization of abrasive jet machining and magneto finishing. The latest hike in the use of hard, high potency and temperature resistant equipment in engineering imposed the progress of new-fangled machining techniques. Traditional machining or concluding processes are not readily related to the materials like carbides; ceramics. Traditional machining procedures when concerned to these new-fangled materials are too costly, Create reduced degree of surface finish and precision; generate some stress, extremely deficient. New-fangled machining procedures may be categorized due to temperament of energy in work. Abrasive flow machining (AFM) is somewhat new procedure along with non-traditional machining processes. Low substance elimination rate occurs to be one serious inadequacy of nearly the entire procedures. Magneto abrasive flow machining is an innovative expansion in AFM. By means of magnetic field in the region of the work portion in abrasive flow machining, we can amplify the material removal rate in addition to the surface finish.

Keywords: Magneto Abrasive Flow Machining (MAFM), Material Removal Rate, Surface Finish, Abrasives.

(I) Introduction:

Magneto abrasive flow machining (MAFM- machining with the help of magnetic abrasives) is a well known technique in industry. A machining process called orbital flow machining is being claimed to be improvement over abrasive flow machining process which can operate complex components under three dimensional machining. These processes are well known as *hybrid machining processes* (HMP) – which is a recent concept in non-conventional machining advancement. Material removal rate is considered as a general problem in almost every nonconventional machining process and several attempts are underdevelopment to overcome these problems. An ongoing research project is being conducted with the main objective of exploring techniques for material removal rate in abrasive flow machining and this paper reports the preliminary result of that ongoing project.
Magneto Abrasive Flow Machining Process was developed in 2002 for the purpose to increase the material removal rate (MRR) and enhancement in surface roughness of component by polymer base abrasive laden medium with the mixture of ferromagnetic abrasive particles in Abrasive Flow Machining Process. In this new hybrid technique, the two poles are enclosed by coil aligned in that way to deliver strong fascinating magnetic field in AFM process, it was reported that application of fascinating magnetic field with AFM process, enhanced the number of vibrant dynamic grains involved in cutting action.

(II) Extraction of Data:

Primary need of the research requires the collection of imperative data where as some organizations utilizing Abrasive flow kind of surface finishing machines for their manifestations. The certainties interlinked to Abrasive Flow Machining are gathered from such companies. Just a few imperatives are compulsory to be assumed as all the data can't be accomplished from the enterprises. This paper presents the evaluation of different cases on the basis of various parameters and at last phase all the data being joint and analysed for various perspectives and parameters such as magnetic flux density, flow rate (volume) of the medium, grain size and concentration of the abrasive, work piece material, reduction ratio, viscosity of the medium, extrusion pressure, number of cycles and, flow volume of the medium.

(III) Comparison with Abrasive Flow Machining:

1. Magneto Abrasive Flow Machining can correct surface irregularities such as bumps and out of roundness while Abrasive Flow Machining suffers at this point.
2. In Magneto Abrasive Flow Machining, machine depth can be increased by amplifying magnetic flux density while machine depth in Abrasive Flow Machining depend on only increase of particle size and working clearance.
3. Magneto Abrasive Flow Machining has improved surface finish than Abrasive Flow Machining.

4. Magneto Abrasive Flow Machining requires less number of cycles as compare to Abrasive Flow Machining to achieve the targeted machining.
5. Magneto Abrasive Flow Machining surely has material removal rat e better than Abrasive Flow Machining.

(IV) Procedure:

The investigations were executed by AFM technique on tube shaped occupation. The coarse used in the media are silicon carbide. The mix of media is various in the organization of the coarse components of conscientious work measure in an unmistakable rate to achieve the favored extent consultation of rough units by load. Before playing out the genuine testing, the transitional was kept running for 20-25 cycles with the tryout work, to get institutionalized amalgamation. In light of the finale from the preparation testing, three significant factors are the quantity of cycles, coarse system degree, and coarse consideration. Inquires about are made by modifying one variable and remaining others foreordained. The whole inquires about were practiced on occupation surfaces comprise of barrel shaped division. Substance disposal rate was the yield rebound planned as presentation pointers in each box. the researches were executed by AFM procedure on cylindrical job. The coarse utilized in the media are silicon carbide. The blend of media is assorted in the company of the coarse elements of scrupulous mesh size in a distinct percentage to accomplish the preferred proportion deliberation of abrasive units by load. Prior to performing the actual testing, the transitional was run for 20-25 cycles with the audition job, so as to obtain standardized amalgamation. Based on the finale from the groundwork testing, three noteworthy erratic are the quantity of cycles, coarse network extent, and coarse deliberation. Researchers are made by altering lone variable and remaining others predetermined. The entire researches were accomplished on job surfaces consist of cylindrical division. Substance elimination rate was the output comeback premeditated as recital pointers in every crate.

A. Experimental Resources

The aluminum-6061 composite as a vocation substance is utilized. The curved space assign machined in the activity which is adapted by penetrating procedure and after that trailed by exhausting procedure for mandatory measurement i.e. greatness 7 mm inner breadth , 12 mm outside measurement and 50 mm remove end to end. The internal barrel shaped surface was finished and finished with AFM movement. The media definition utilized for this pack comprising silicon based polymer, pressure driven oil and silicon carbide as coarse grain. Every job-piece is machined proposed in favor of a foreordained amount of cycles. The job-piece was being used somewhere else from the arrangement of associations and unsoiled before any estimation is taken.

B. Process Parameters:

The chosen factors and their assortment in support of the comprehensive research as given away in the Table below,

Table: Chosen Method Factors and Their assortment

S. No.	Process factors	Range	Unit
1.	Abrasive atom dimension	140-240	Micron
2	No of successions	60-160	-
3	Job material	Al – 6061 alloy	-
4	Coarse Deliberation	45-55	Percentage

C. Experimental Investigation:

The test outcomes are analyzed by means of Taguchi method. L9 orthogonal selection is chosen in favour of the method. The input factors are:

(A) Abrasive deliberation,
(B) Abrasive network extent,
(C) No of cycle, and
(D) Production Retort Is MRR.

Table: Proportion Composition of Essentials in Job Piece Substance

Constituent	Job piece (Al - 6061)
Cu	0.015
Mg	0.465
Si	0.522
Fe	0.545
Ni	0.0048
Mn	0.164

Zn	0.0180
Pb	0.0196
Sn	<.00150
Ti	0.0201
Cr	0.0076
Al	99.87

D. Experimental Interpretations:

Some experimental interpretations are made as shown in the table below,

Table: Experimental interpretation

Coarse deliberation (%)	**Mesh extent**	**No of cycle**	**MRR (mg/s)**
50	150	50	2.45
50	220	100	2.79
50	250	150	2.98
55	150	100	3.36
55	220	150	3.52
55	250	50	2.83
60	150	150	3.85
60	220	50	3.29
60	250	100	3.39

Table: L27 Orthogonal array, MRR after each experiment

	Factors				
Exp. No.	**A**	**B**	**C**	**MRR 1 10^{-3}g/s**	**S/N ratio**
1	1	1	1	2.45	7.7833
2	1	2	2	2.79	8.9121
3	1	3	3	2.98	9.4843
4	2	1	2	3.36	10.5268
5	2	2	3	3.52	10.9309
6	2	3	1	2.83	9.0357
7	3	1	3	3.85	11.7092
8	3	2	1	3.29	10.3439
9	3	3	2	3.39	10.6040

E. Outcome and Argument:

The investigation of current work is made by using Taguchi method on MINITAB software. Abrasive deliberation is initiated as supplementary considerable factor, then number of cycles and then coarse extent for material removal rate. It is pragmatic that the same as abrasive deliberation augments MRR augments. On increasing abrasive mesh size MRR decreases. As the no of cycle increases, MRR increases.

F. Material Removal Rate

Weight of the work piece was measured before and after the machining operation has been noted. Material removal rate was calculated by using the formula.

MRR = (Initial weight – Final weight) / Time

(V) Conclusion:

An attractive field has been related in the locale of a segment being in strategy by rough stream machining as well as an expanded pace of substance evacuation has been practiced. Exact demonstrating by way of the assistance of reply face has escorted to the accompanying end concerning the inconsistency of reaction limitations as far as free requirements inside the exact arrangement.

1. Attractive field prominently impacts both MRR and surface coarseness. The inclination of the bend implies that MRR enhances by methods for attractive field in overabundance of surfaces unevenness. In this manner, all the more updating in MRR is foreseen at still raised estimations of attractive field.
2. For a predefined quantity of cycles, there is an observable up-gradation of MRR and exterior unevenness. Littler amount cycles are imperative intended for taking out the indistinguishable quantity of substance from the constituent, whenever advanced in the attractive turf.
3. Attractive turf and medium stream pace interrelate by way of each other .The amalgamation of stumpy stream charge and taking off interesting transition thickness yield more substance end pace and littler surface unevenness.
4. Medium stream rates don't have an important result on substance disposal pace and surface unevenness in the presence of an attractive field.
5. Substance end pace and surface unevenness both dimension off consequent to a clear number of cycles.

MAFM is a dug in refined finishing up process capable of meeting the changed closing necessities from various section of use like aviation, wellbeing and vehicle. It is commonly helpful to end composite figures for improved surface unevenness esteems and unbending abstinences. Be that as it may, the principal disadvantage of this methodology is short closing rate. The unrivalled introduction is practiced if the system is controlled on the web. Thus, sound-related discharge technique is tried to investigate the exterior complete and material rejection. A variety of demonstrating techniques are likewise practiced to display the methodology and to connect with investigational results. Yet, pros guess that there is still extension for an arrangement of flawlessness in the close-by MAFM review.

In the current effort Al-6061was punctured and exhausted by customary machining capacity and surface finishing up was made by methods for rough stream machining. Testing was grasped for information requirements like rough pondering, grating system degree and no of cycles. The yield counter is substance disposal pace. Based on results the twisting up is:

1) Finishing of confused to achieve surface can be made by methods for rough stream machining.
2) Because of Taguchi system, it is experiential that grating fixation is essential viewpoint for MRR. Substance disposal pace intensifies with lift in grating focus.
3) As the no of cycle raises, the substance disposal pace additionally rise.
4) Substance disposal pace decays with lift in grating lattice estimate.

References

1. Singh S, Shan H. S, “Development of magneto abrasive flow machining process”, *International Journal of machine tools and manufacture*, Issue number 42 (2002), 953-959.
2. L.J Rhoades, Kohut T.A, Nokovich N.P, Unidirectional abrasive flow machining, *US patent number* 5, 367, 833, Nov 29th,1994.
3. Gorana V.K, Lal G.K, “Forces prediction during material deformation in magneto abrasive flow machining”, *Journal of manufacturing systems*, Issue number 260 (2006),128-139.
4. V.K Jain, R.K Jain, “Modeling of material removal and surface roughness in magneto abrasive flow machining process”, *International Journal of Machine tool & manufacture*, Issue 39 (1999), 1903-23.
5. Jha S, Jain V.K, “Design and development of the magneto rheological abrasive flow finishing process”, *International Journal of machine tool & manufacture*, Issue number 44 (2004), 1019-1029.
6. Ramandeep Singh, &R.S. Walia - " Study the Effects of Centrifugal Force on Abrasive Flow Machining Process" at IJRMET Vol. 2, Issue 1, April 2012.
7. Jose Cherian, Dr Jeoju M Issac - "Effect of process variable in abrasive flow machining" at International Journal of Emerging Technology and Advanced Engineering**,** (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 2, February 2013).
8. P.D. Kamble, S.P. Untawale and S.B. Sahare - " Use of Magneto Abrasive Flow Machining toIncrease Material Removal Rate and Surface Finish" at VSRD international journal of mechanical, automobile and production engineering VSRD-MAP, Vol. 1 (7), 2012, 249-262
9. M.Barletta. 2005. A new technology in surface finishing: Fluidized bed machining (FBM) of aluminum alloys. Journal of Materials processing Technology 173(2006) 157-165
10. Jain R K, Jain V.K, Dixit P.M; Modeling of material removal and surface roughness in Abrasive flow machining. International journal of Machine tool and manufacture. 30(1999) 1903-1923.
11. Rhoades L.J; “Abrasive flow machining with not-so-silly putty”, Metal Finishing, July, 1987.