International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)

Impact Factor: 5.858 (SJIF-2019), e-ISSN: 2455-2585

Volume 6 , Issue 9 , September -2020

CHANGE IN MATERIAL REMOVAL RATE WHILE USING "MAGNETO ABRASIVE FLOW MACHINING"

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Abstract - In this paper, we will discuss the effect of change in material removal rate of Magneto Abrasive Flow Machining. Abrasive flow machining is a mechanized method that is surge of under pressure coarse medium to eliminate work piece substance and get better outer surface unevenness. AFM is extremely proficient and appropriate for finishing of complicated internal surfaces and hard getting in touch with surface. In the current study the consequence of variant input constraints on MRR has been explored with Taguchi analysis. An investigational study was performed on Aluminium work piece. The coarse size, characteristics of carrier, number of cycle and abrasive deliberation are main constraints that have an effect on the performance of AFM. The purpose is to study the consequence of procedure variables on material removal rate.

Keywords: Magneto Abrasive Flow Machining (MAFM), Material Removal Rate, Abrasives, Machining, Finishing, Taguchi method

(I) INTRODUCTION:

Magneto Abrasive stream machining (MAFM) is single of the overall creation un-standard machining structures, which diminishes amazing limits as for finishing and machining of hard to appear at inconsistent complex zone of parts. It has been for all intents and purposes utilized for smoothening, radiusing, and removing re-made layers out of districts. A ton of surface aggregate and enough close adaptability's have been clean for a wide gathering of parts .In MAFM, a semi-solid framework including a polymer-established carrier and a coarse in a regular degree is cleared below strain through or over the faces to be contrapted. These techniques begin as a distorted mechanical social affair of beating any time he is familiar with any control. Shocking mechanical assembly is usually required to create a bounding part or to control the environment intended for zones in a work piece.

Reliably there exist three sorts of AFM philosophy: - One way, two novel ways and Orbital AFM. In a standard Two mode AFM framework here are two compartment buns, one siphons a devastating slurred medium from the lower chamber totally through and one as of the higher barrel makes one improvement for the fine machining of the parts which set tangled structure, opening and disabled person, there is being a require experienced to grow fine machining frameworks which can bring into being shapes by method for shocking centrality and calm high sound judgment The coarse slurry floods underneath weight inside the action piece.

Advantages must be on an essential level fundamental in AFM. Transporter ought to be visco versatile and un-unforgiving in character. The polymer coarse media which be used in the midst of this preparation gets simple flood limit, unparalleled self-deformability and especially well grinding down potential Fundamentally, mover slurry used to be silicon polymer. Silicon polymer is all things considered glutinous to break and eccentric shape or math. Everything considered used coarse grains are Silicon Carbide, Aluminium Oxide, Boron Carbide and Critical Stone. Foundation arrangement is most enormous thing to concern the result data out of the blue. Sort of machine and furthermore kind of contraption pick the cut-off points, for instance, upsetting sort used and put where this sort is to be used.

(II) SCOPE OF RESEARCH:

The most important intent of this assignment is headed for:

1. Augment the substance elimination pace as of with the coarse surge machining
2. Dwindle the number of sequence for the material elimination rate necessary just by straightforward alteration of shifting the media, fascinating structure, and prologue of centrifugal compel we be able to be in the point of fact augment superiority of amount produced at fewer outlay of amendment.
3. Get the AFM & surface evenness to a extreme-fangled echelon to conquer unaccomplished principles, which not merely force augment the merchandise superiority except in addition augment the use of homogenize auxiliary, eventually escalating life anticipation of the merchandise lacking any heave at any type of disbursement on the auxiliary.

(III) IMPLEMENTATIONS PROCEDURE

Despite the fact that the assignment is not that straightforward as it gives the impression to be, as it necessitate a no. of procedures, it can be done into leaps for its flourishing accomplishment. The entire project is fundamentally alienated into three divisions:

1. Data gathering from dissimilar groups for fundamental functions of the machine.
2. Study on the data assembled
3. Optimized the transformations to opt for the superlative amendment and superlative abrasive material for surface finish.

The primary section of the venture requires some period to collect all imperative components. There are sure neighbouring organizations which are utilizing this type of surface completing machines for their manifestations. The certainties interconnected to the requirements of AFM will be gathered from such companies. Just a few imperatives are compulsory to be assumed as all the data can't be accomplished from the enterprises. So by settling on reasonable imperative we can seal in the cuts for the pace one to be accomplished. The second pace grasps exercise of an appropriate strategy for surface estimation and correlation of the data aggregated. Just a few cases would be endorsed in spite of the fact that a no. of cycles at various conditions. These cases would be the experiential under the electron magnifying instrument for the evaluation. Third pace is to joint and analyzed this data on any of the examination programming to go for the most ideal strategy. It will spotlight to join assorted procedures for an improved and cross breed surface completing strategy.

(IV) COMPONENTS:

Following are the machine components of Abrasive Flow Machining.

1. Cylinder enclosing medium,
2. Flange,
3. Fixture of Nylon,
4. Work piece,
5. Eye bolt,
6. Hydraulic press,
7. Auxiliary cylinder,
8. Modular relief valve,
9. Piston of Hydraulic press,
10. Directional control valve,
11. Manifold blocks

(V) METHOD CONSIDERATIONS:

1. Subsequent method considerations be conjectured to manipulate the recital of MAFM:
2. Magnetic flux density
3. Flow rate (volume) of the medium,
4. Grain size and concentration of the abrasive,
5. Work piece material,
6. Reduction ratio,
7. Viscosity of the medium,
8. Extrusion pressure,
9. Number of cycles and,
10. Flow volume of the medium

(VI) ADVANTAGES OVER ABRASIVE FLOW MACHINING:

AFM	MAFM
1. Surface irregularities such as scratch, Bumps, Out of roundness cannot be corrected. 2. Machined depth increased by a) Increase in particle size b) Smaller working clearance 3. Surface finish improved by a) Higher relative speed b) Smaller working clearance c) Surface finish = 0.05-1.0µm 4. More number of cycles is requisite for superior matter ejection rate. 5. Material removal = 0.008 – 0.010mm 6. Medium flow rate is only factor which yields material removal rate but surface roughness is high as compare to MAFM	1. Surface irregularities such as scratch, Bumps, Out of roundness can be corrected. 2. Machined depth increased by a) Amplification in magnetic flux density b) Increase in particle size c) Smaller working clearance 3. Surface finish improved by a) Higher relative speed b) Increase in flux density c) Increase in finishing time d) Smaller working clearance e) Surface finish = 3.0-5.0µm 4. Fewer number of cycle is requisite for superior matter ejection rate 5. matter ejection = 0.020 – 0.030mm 6. Fascinating attractive field and medium stream rate connect with one another and mix prompts high material expulsion rate and little surface unpleasantness.

(VII) PRINCIPLE:

The measure of coarse constituent part is yielded by the grating liquid flood completely through the activity. Abrasives are infringed at work with a predefined compel which is blessed with the cylinder and barrel settlement or by methods for the assistance of an intensifier incite The weight vitality of the fluid is restored enthusiastic about dynamic vitality of the fluid in sort to get transcending quickness. While a solid enrapturing captivating field is useful in the district of the activity, the exquisite coarse constituent part encounter an inclining pull that establishes an avoidance in their pathway of group to secure them to infringe on to the activity surface with a modest inclination, consequently consequential in miniaturized scale chipping of the shell.

The enchanting alluring field is in like manner at risk to concern the coarse assignment show at the machining plane of the action piece. The particles that or, more than likely would have recognized without perceptible the surface at present surprise their pathway and addition an enthusiastic part in the scrape movement, in this manner root an enlargement in substance disposal.

It is to raise here that despite the fact that the automatic take cause by the entrancing enrapturing field is modest, it is satisfactory to divert the coarse constituent part, which are formerly mixing at huge energy. Thus it comes into see that, by alluring nature of the capacity of the captivating field, extra coarse units hit the outside. All together, a couple of them force on the face at humble position, resulting in an enlarged total of basic wear and in that manner abundant increment to an ordinarily expansion of substance end pace.

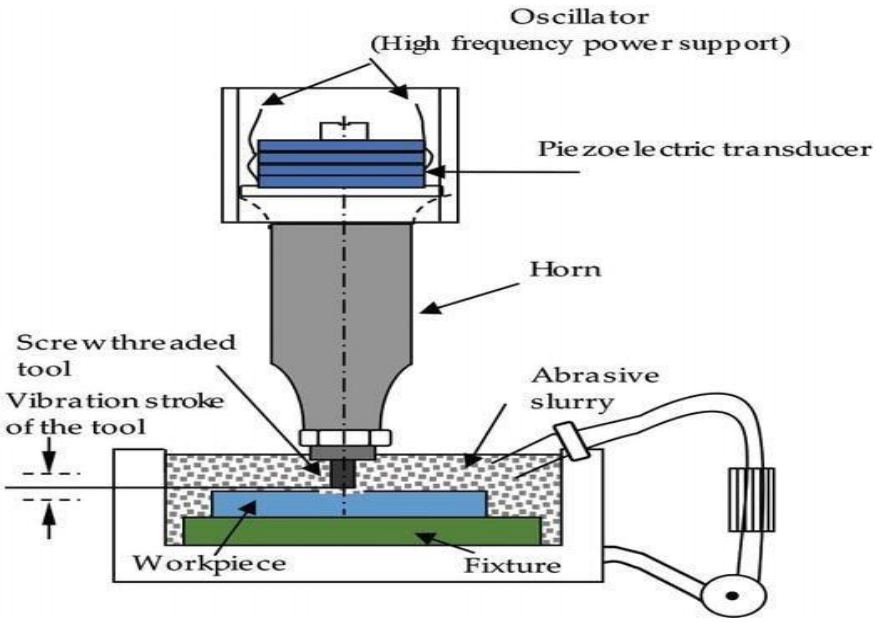
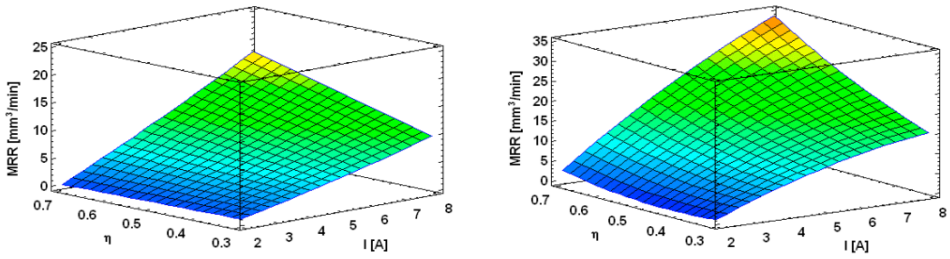


Fig: Basic Principle

(VIII) MECHANISM OF MATERIAL REMOVAL

Strong constituent part whittling down foreseen by methods for Finnie is well thoroughly considered as the key component of substance end in MAFM with some change. In grating plane machining the vitality of the unmistakable coarse molecule is told by the transcending force of the medium stream, however in MAFM the essential vitality to the coarse constituent part is offered by raised weight substituted on the visco-versatile carter medium. The medium grow and the coarse constituent part comes underneath a far over the ground dimension of strain proper to the weight acting in the limitation. The force that coarse constituent part gets your hands on because of this circumstance can be well thoroughly considered to be responsible for small scale stopping and miniaturized scale chipping of the shell in connect with the coarse constituent part. Small scale stopping roots plastic clasp on the substance of the metal. Basically regardless of end happens. Then again, the surface molecule transforms into all the more unprotected to keeping out by resulting coarse grains. More coarse components ambush the surface regularly, which root the indifference of substance again and again passed on to as 'cutting wear'.



(a) Positive polarity (+) (b) Negative polarity (−)

Fig.: Effect of Magnetic Flux Density and Medium Flow Rate on MMR

At what time a solid entrancing attractive field is utilitarian in the district of the activity piece, the exquisite coarse constituent part encounter an inclining drag with the purpose of establishes a diversion into their pathway of group to secure them in the direction of infringe on top of the activity surface among a petite inclination, in this manner resulting in smaller scale chipping of the shell. The charming attractive field is likewise prone to concern the coarse designation show at the machining plane of the activity portion. The constituent part that or else might have acknowledged devoid of unmistakable the exterior at present alter their pathway and secure an enthusiastic fraction in the scrape movement, in this manner root an expansion in substance end. It is to raise here that despite the fact that the automatic pull incite by the entrancing dazzling field is little, it is satisfactory to divert the coarse constituent part, which are already blending at noteworthy energy. Subsequently it comes into view that, by attractive nature of the capacity of the entrancing attractive field, more coarse particles hit the surface. All together, a couple of them force on the face at modest position, resulting in an expanded total of basic wear and in that way plentiful increment to a typically increase of substance disposal pace.

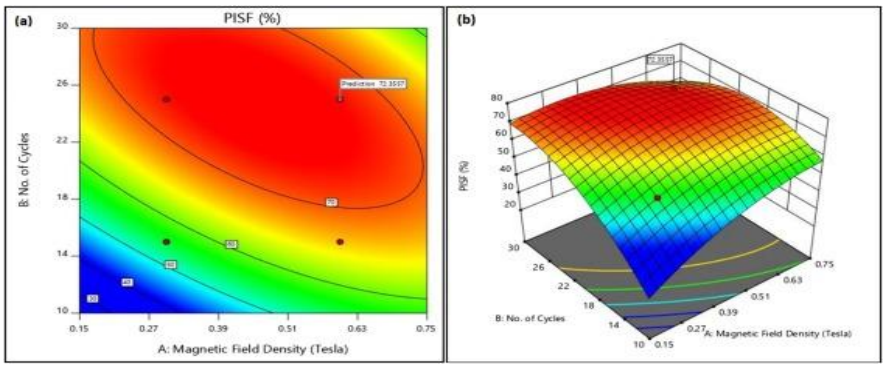


Fig: Effect of Number of Cycles and Magnetic Flux Density on MRR

(IX) ADVANTAGES

- MAFM deburrs exactitude gears.
- A very lofty amount of inner deburring is potential.
- MAFM buff up inner and outer attributes of a range of components.
- MAFM does away with recast film from workings.
- Efficient on each and every metallic material
- Controllability, repeatability and cost effectiveness.
- A lesser amount of instance spending.

(X) LIMITATIONS

- Coarse materials have a propensity to acquire rooted, if the job material is squashy.
- Necessitate blocked surroundings.
- Want set up opening
- More often than not -captivating material

(XI) 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

(XII) CONCLUSION:

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.

An appealing field has been connected in the district of a section being in procedure by harsh stream machining just as an extended pace of substance departure has been polished. Careful showing by method of the help of answer face has accompanied to the going with end concerning the irregularity of response confinements to the extent free necessities inside the specific plan.

1. Attractive field obviously impacts both MRR and surface coarseness. The propensity of the bend construes that MRR improves by procedures for charming field in abundance of surfaces disproportion. Consequently, the more invigorating in MRR is foreseen at still raised estimations of appealing field. For a predefined amount of cycles, there is a perceptible up-degree of MRR and outside lopsidedness.
2. Humbler sum cycles are basic expected for taking out the undefined amount of substance from the constituent, at whatever point progressed in the appealing turf.
3. Attractive turf and medium stream pace interrelate by strategy for each other .The amalgamation of short stream charge and taking off captivating change thickness yield more substance end pace and more minor surface disparity. Medium stream rates don't have a significant outcome on substance removal pace and surface lopsidedness within the sight of an alluring field.

Table: SN Ratio for material removal rate using ANOVA

Factors	DOF	Seq SS	Adj MS	F	P	Remarks
A	2	7.2496	3.62478	33.9	0	mainly considerable
B	2	0.2177	0.10884	1.77	0.46	
C	2	4.138	2.06902	22.2	0.04	considerable
Slip	2	0.1863	0.09317			
Overall	8	11.7916				
R^2 = 98.4						

Table: Means for material removal rate using ANOVA

Factors	DOF	Seq SS	Adj MS	F	P	Remarks
A	2	0.91429	0.457144	74.4	0.013	mainly considerable
B	2	0.041169	0.020844	3.39	0.228	
C	2	0.52949	0.264744	43.09	0.023	considerable
Slip	2	0.01229	0.006144			
Overall	8	1.49776				
R^2 = 99.2						

Table: Main Constituents

Constituent	Job piece (Al - 6061)
Cu	1.5%
Mg	0.465%
Si	0.522%
Fe	0.545%
Ni	0.48%
Mn	0.164%
Zn	0.180%
Pb	0.196%
Sn	<1.50%
Ti	2.01%
Cr	0.76%
Al	92.87%

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