Analysis of Surface Roughness in Abrasive Flow Machining by Taguchi Technique

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Abstract : Abrasive flow machining (AFM) is a progressed nonconventional machining process, which is utilized to deburr, machine complex shape and a successful method to clean unsymmetrical, ordinary/unpredictable surfaces and inside structure of parts, which are hard to reach by any customary machining process .In this procedure rough medium is expelled forward and backward through the entries of the metal work-piece and tooling is created to hold the work piece immovably. In this examination, the impact of process parameters are abrasive size, number of cycles and pressure were optimized. In the improvement surface harshness is taken as yield. In present trial think about, the impact of process factors on surface harshness was exhibited by L9 symmetrical cluster dependent on Taguchi and ANOVA Technique utilizing Minitab17 which gives a satisfactory reproduced outcome.

***IndexTerms* - Abrasive Flow Machining, ANOVA, brass, Minitab17, Surface Roughness, Taguchi method.**

I. INTRODUCTION

Abrasive flow machining (AFM) is a non-customary machining process which is produced as a strategy for surface completing, edge forming, suspending and surface wrapping up. It can beat zones that are not actually reachable by conventional strategies for blending rough polymers with specific rheological completing properties. During the time spent machining the slow of abrasive, the framework based polymer of viscoelastic material that is blended with abrasive particles and added substances that are alluded to as a medium, forward expelled forward and in reverse into two vertically restricted cylinders[1]-[4]. While it is expelled through the entry framed by the work piece to be machined, this implies endeavors to specifically end the work piece surface. The apparatus has a critical job in this procedure. So the instrument or settling configuration ought to be finished with care.[5]-[6]Experimental setup

Machining setup consists of following components

1. Hydraulic Pump
2. Hydraulic cylinder
3. Abrasive medium cylinder
4. Pressure gauge
5. Piston
6. Tooling

If the working and machining in AFM is focused the system consists of three major components i.e.

1. Machine
2. Media
3. Tooling

A semi-strong polymer-based media containing rough abrasive in a specific extent is travel through the work-piece at a specific pressre. The self-deformable property of the media empower it to travel through arranged entries and goes about as an adaptable rough stone to give a completed surface. For assessing the surface Unpleasantness a gadget is utilized knows as perthometer.

II. CONTROLLABLE PARAMETERS AND DESIGN MATRIX

The possible parameters of AFM are abrasive, Size of abrasive and Number Of Cycle. The standard purposes of this investigation are to finished the examinations by picking differing factors and their dimensions, applying Taguchi Symmetrical exhibit (OA) of examination and a while later exploring the results got. The quantity of perception were done as proposed by the Taguchi trial configuration as per some of a procedure variable, their dimensions, and their coordinated efforts. In perspective of the above nature of an investigation, the required least number of perception to be immediate. The nearest OA fulfilling this condition is L9. It can suit a biggest three number of the control component, each at three dimensions. with 9 tests.

The scientific methodology through MINITAB measurable device concentrates many process parameters in the meantime and improved the reaction that for the most part generally financially.

TABLE I

SELECTION OF FACTORS AND LEVELS.

CONTROL FACTOR	LEVELS			RESPONSES
	1	2	3	
PRESSURE (kgf/cm^2)	10	25	40	SURFACE ROUGHNESS(Ra)
SIZE OF ABRASIVE	80	120	220	
NUMBER OF CYCLE	100	300	500	

TABLE II

TAGUCHI DESIGN MATRIX AND RESPONSE

	Input parameters			Response
EXP NO	Pressure	NOC	SOA	Ra
1	10	100	80	0.38
2	10	300	120	0.55
3	10	500	220	0.58
4	25	100	120	0.65
5	25	300	220	0.71
6	25	500	80	0.7
7	40	100	220	0.98
8	40	300	80	0.8
9	40	500	120	0.8

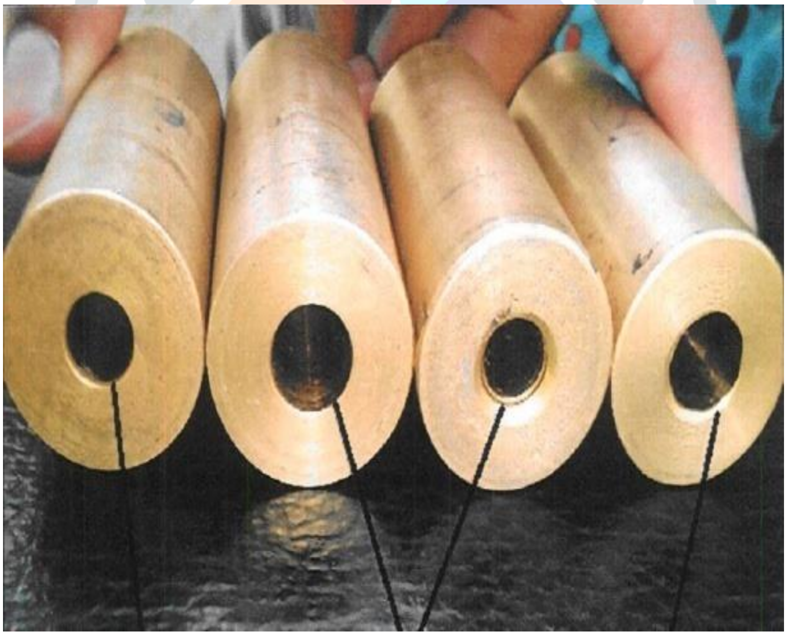

Fig.3. Brass workpiece

III. RESULT AND DISCUSSIONS

S/N ratio Analyze - Taguchi approach accentuation on the significance of breaking down the trial reaction deviation applying a flag to clamor proportion that in charge of the decrement in the variety of process trademark because of wild factors. The surface roughness was treated on "large-the-better" concept**.**

Taguchi Analysis: surface roughness versus Pressure (Kgf/cm2), NOC, SOA.

TABLE III

RESPONSE TABLE FOR SIGNAL TO NOISE RATIO (LARGER IS BETTER)

Level	Pressure (Kgf/cm^2)	NOC	SOA
1	-6.110	-4.107	-4.480
2	-3.272	-3.369	-3.624
3	-1.351	-3.259	-2.627
Delta	4.759	0.851	1.853
Rank	**1**	**3**	**2**

Ranks at a table of S/N ratio that will help quickly determine, which factors have the greatest impact on results. The larger delta value of factor given rank 1. The Pressure is higher contribution factor for surface roughness.

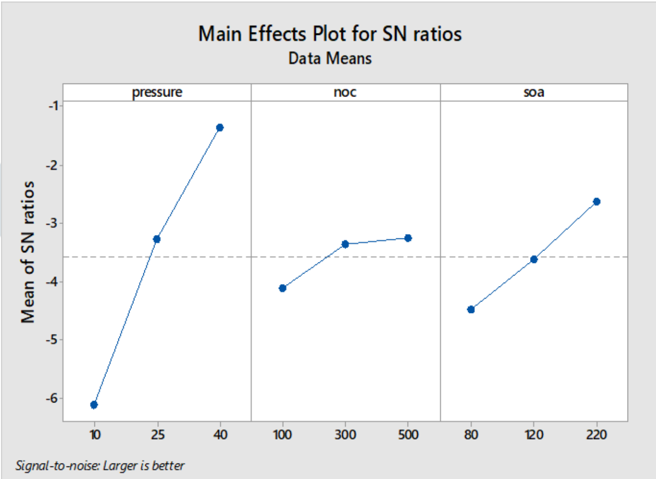

Fig. 4. Parametric effect on surface roughness

TABLE IV

ANALYSIS OF VARIANCE FOR SURFACE ROUGHNESS

Source	Contribution	Adj. SS	Adj. MS	F-Value	P-Value
Pressure	80.24%	0190817	0.190817	48.72	0.001
NOC	0.34%	0.000817	0.000817	0.21	0.667
SOA	11.18%	0.026585	0.026585	6.79	0.048
Error	8.23%	0.019582	0.019582		
Total	100%				

Analysis of variance with R-sq. is 91.77% and R-sq.(adj) is 86.82%. Amid the procedure of abrasive flow machining, the impact of fluctuated information factors like pressure, number of cycle and size of rough has huge on surface harshness as a presentation in fundamental result plot of S/N proportion in fig.4. pressure is the most huge factor influencing the Surface Harshness. The pressure is demonstrated proportionality conduct with Surface Harshness.

FIG4 demonstrates that Size Of Abrasive(SOA) additionally demonstrate a proportionality conduct with Surface Unpleasantness and right off the bat bend of Number Of Cycle(NOC) indicates proportionality conduct with Surface Harshness after that bend appears on expanding NOC the Surface Unpleasantness is steady. Investigation of fluctuation is factually Apparatus for the distinguishing proof of affecting variables Execution measures in a given arrangement of information. The Minitab is utilized to investigate the Impact of Process Parameters. ANOVA approve the examination with R-sq. 91.77% and R-sq.(adj) 86.82%. Weight observed to be a most suitable parameter.

IV.CONCLUSION

The present work has come to the accompanying resolutions:

1. The Surface Roughness (RA) could be anticipated adequately by applying expulsion pressure, number of cycles and Size Of Abrasive (SOA), by utilizing taguchi technique in Minitab program.
2. The R^2 (capacity the Autonomous qualities to anticipate the reliant qualities) of the prescient model is 91.77%.
3. ANOVA is utilized to discover the centrality of the machining parameters and their commitments on surface unpleasantness separately.
4. The weight is the most critical machining parameter to impact Surface Roughness (RA).

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