An Experimental Study And Analysis On Influence Of Process Parameters On Abrasive Jet Drilling Of Glass

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Abstract **- Penetrating of glass with various SOD's, Pressures have been done by Abrasive Jet Drilling process (AJD) so as to decide its machinability under various controlling parameters of the AJM procedure. Rough fly machine (AJM) expels material through the activity of centered light emission loaded gas. Miniaturized scale rough particles are pushed by a latent gas of speed. At the point when coordinated at a work piece, the subsequent disintegration can be utilized for cutting, drawing, penetrating, cleaning and cleaning. In this paper advancement of procedure parameters of Abrasive Jet Machining of glass by Taguchi system is exhibited. The Values acquired in Taguchi Analysis was contrasted and the Analysis of Variance (ANOVA).Various levels of Experiments are led utilizing L9 Orthogonal Array**

keywords **- Abrasive Jet Machining, Erosion rate, Glass, AJD, SOD, Pressure**

I. INTRODUCTION

In Abrasive Jet Machining, fine rough particles (regularly ~0.025mm) are quickened in a gas stream (generally air) towards the work surface. As the particles sway the work surface, they cause little breaks, and the gas stream conveys both the rough particles and the cracked (wear) particles away. A high-speed fly of dry air, nitrogen, or carbon dioxide Containing grating particles is focused on the work piece surface under controlled conditions. The stream speed is in the scope of 150-300 m/s and weight is from two to multiple times climatic weight. Rough Jet Machining is utilized for penetrating, deburring, drawing, and cleaning of hard and fragile metals, combinations, and non-metallic materials (e.g., germanium, silicon, glass, earthenware production, and mica). No warmth is required during the time spent machining a piece with a grating plane. Thus, parts from a get together don't encounter auxiliary changes from overheating. There are no poisonous squanders radiated by rough water planes, and no oils are fundamental during the time spent machining. Aluminum oxides, silicon carbides, Boron Carbides, Crushed glass, Sodium bicarbonate, Dolomite are Various Abrasive Particles utilized for Machining in Abrasive Jet Machining. Reuse of abrasives isn't suggested since the cutting capacity of grating decline after the utilization and furthermore the defilement of wear materials stopping up the spout and the cutting unit hole. The Major Process Parameters that will influence the MRR in AJM are 1. Gas Pressure 2. Speed of Particles 3. Grating mass stream rate 4. Blending proportion 5. Spout Tip Distance.

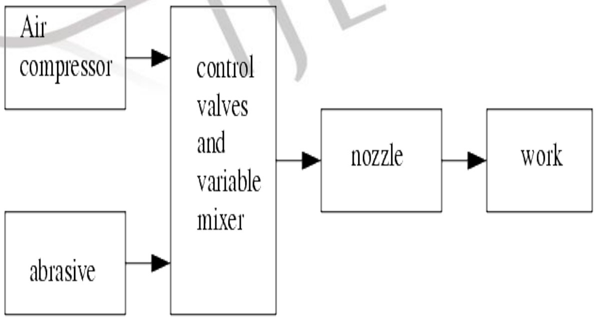

Fig 1: Line Diagram of Abrasive Jet Machining Process

II. LITERATURE REVIEW

The rough corn meal (sand) were blended in with air stream in front of the spout and the grating stream rate was kept consistent all through the machining procedure. The Results was spoken to with Graphs [1]Apart from the Experimental works point by point hypothetical investigations are additionally performed on Abrasive Jet Machining(6,7,8).Most of the examinations contend over the hydro dynamic qualities of rough streams, subsequently discovering the impact of every single operational variable on the procedure adequacy including grating type,size and focus, sway speed and edge of impingement(1). Different papers found new issues concerning transporter gas typologies, spout shape, sizeand wear, fly speed and weight, standoff separation (SOD) or spout tip separation (NTD). These papers express the general procedure execution as far as material expulsion rate, geometrical resiliences and surface completing of work pieces(2,3), just as far as spout wear rate. At last, there are a few noteworthy and significant papers which center around either driving procedure instruments in machining of both pliable and fragile materials, or on the improvement of precise trial factual methodologies(4,5), Analysis and fake neural systems to foresee the connection between the settings of operationalvariables and the machining rate and exactness insurface finishing(9,10). As of late grating jetmachining has been increasing expanding adequacy for penetrating applications.

III. Experimental Procedure

Exploratory plan is a helpful supplement to multivariate information examination since it produces "organized" information tables, for example information tables that contain a significant measure of organized variety. This basic Structure will at that point be utilized as a reason for multivariate demonstrating, which will ensure steady and vigorous models. The DOE Technique ponders numerous components at the same time and most monetarily. By contemplating the impacts of individual Factors on the outcomes, the best factor blend can be resolved. Enhancement dependent on TAGUCHI approach is utilized to accomplish increasingly productive cutting parameters. Parameter configuration is the key advance in the Taguchi way to deal with accomplish high caliber without expanding cost. To tackle this issue Taguchi approach utilizes an exceptional structure of symmetrical exhibits where the test results are changed into the S/N proportion as the proportion of the quality trademark going astray from the ideal worth.

Experimental Setup

Main machine structure of size 250x250x550 has been fabricated. Lifting mechanism parts have been machined & assembled as shown in Fig. Mixing chamber & hopper have been machined out of M.S sheet and welded. The opening for the abrasive Particles was arranged with air tight and leak proof system.

Fig 2 : Fabricated Experimental Setup of Abrasive jet Machining

Experimental Work

The exploratory work was carried on a test rig. The rough corn meal (Al2o3, Sic) were blended in with air stream in front of the spout and the grating stream rate was kept consistent all through the machining procedure. The fly spout was made of Tungsten Carbide to convey high wear opposition and increment in Life of spout. A few spouts were fabricated with various bore breadths of 1 mm, 2 mm and 3 mm. Penetrating of glass sheets was directed by setting the test rig on the parameters like Pressure, SOD and Nozzle breadth, Abrasive stream rate.

Fig 3: Nozzle fixed to set up

Table 1: Characteristics Of Different Variables

Medium	Air , CO2 ,N2
Abrasive	SiC, Al2O3 (of size 20µ to 50µ)
Flow rate of abrasive	3 to 20 gram/min
Velocity	150 to 300 m/min
Pressure	2 to 8 kg/cm2
Nozzle size	0.07 to 0.40 mm
Material of nozzle	WC, Sapphire
Nozzle life	12 to 300 hr
Standoff distance	0.25 to 15 mm (8mm generally)
Work material	Non Metals like glass, ceramics, and granites. Metals and alloys of hard materials like germanium, silicon etc
part application	Drilling, cutting, deburring,cleaning

Glass was utilized as a work piece material in view of its homogeneous properties. The test examples were cut into square and rectangular shape for machining on AJM unit having thickness 3mm, 4mm. In machine the underlying loads of glass examples were estimated with the assistance of computerized balance. Subsequent to machining the last loads were estimated with the assistance of advanced parity to ascertain the material evacuation rate. First the grating that was Sic in powder structure was encouraged in the container cautiously. After that blower associations were checked. The glass example was appropriately clipped on cross slide with the assistance of different braces. As the Compressor was turned on, the container entryway valve was opened so rough grains were blended in with air fly originating from the blower and concentrated on the example with assistance of spout. Same examinations were with silicon carbide as grating in AJM process. Various readings were taken dependent on the degrees of Taguchi Analysis utilizing diverse procedure parameters (Pressure, Sod, Nozzle distance across.). All outcomes were broke down by Taguchi technique and contrasted and ANOVA.

IV. Results

Experiments are conducted based on Taguchi's method with four factors at three levels each. The values taken by a factor are termed to be levels. The factors to be studied and their levels chosen are detailed in the Table 2.

Table 2: Factors of Taguchi and Levels

Machining Parameters	Level 1	Level 2	Level 3
Pressure (kg/cm^2)	6	7	8
Stand Of Distance (mm)	8	9	10
Nozzle Diameter (mm)	2	3	4

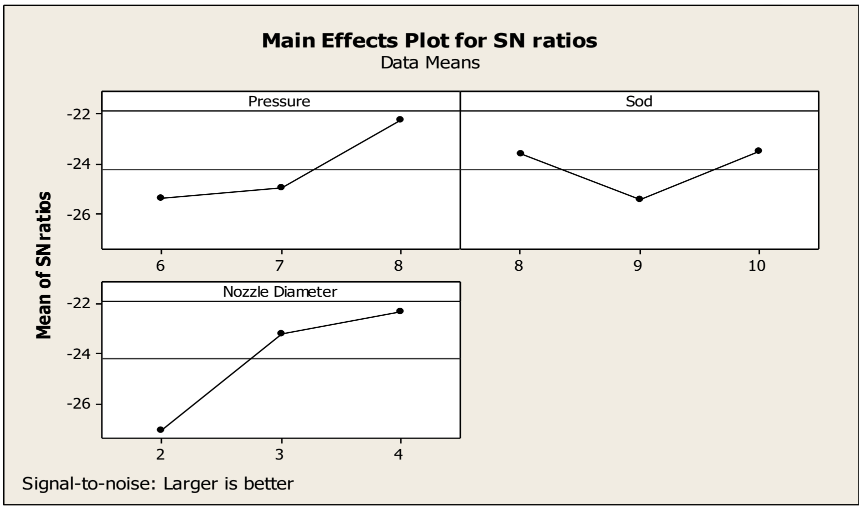

Fig 4: Graphs indicates the Effect of Pressure, Sod, Nozzle diameter on MRR

V. Conclusion

This paper presents that substantial results of experiments have been conducted by varying the pressure, nozzle tipdistance, SOD at varying thicknesses of glass plates. The effect of their process parameters on material removal rate (MRR) is analyzed using the Taguchi method and compared using variance analysis ANOVA. The optimal level of performance found in Larger is superior MRR was identified as air pressure (8 kg / cm2) SOD (8 mm) nozzle diameter (4 mm). The obtained results almost coincide with the ANOVA result. Top surface diameter and bottom surface. The diameter of the obtained hole was measured and plotted.

VI. Acknowledgment

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