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A REVIEW ON THE NON-TRADITIONAL MACHINING PROCESS

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Abstract: The modern day technology advancements have resulted in a need to develop new and efficient ways to machine different work materials. With the conventional ways of machining providing slow and limited application to the machining of different work materials, the non-traditional machining process need to be developed in order to find new and better ways to machine different work materials. The non-conventional machining process provides fast and high quality solution to the machining of different work materials. The non-Traditional machining processes are useful where machining of hard material and complex shapes are required. Moreover the non-Traditional machining processes are better option as compare to the traditional machining process when mass production is considered. In this paper we will discuss various non-traditional machining processes which can be used for the machining process.

Keywords: Non Traditional Machining, AJM, AWJM, WJM, LBM, EBM

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INTRODUCTION

In this paper we will be providing a literature study on the various non-traditional machining processes like abrasive jet machining, Water jet machining, abrasive water jet machining, laser beam machining, electron beam machining, electro chemical machining and electro chemical grinding. The study will include literature survey through various papers and the study will include basic description of the processes and also the study of the individual process parameters which affect the various non-traditional machining processes.

Abrasive Jet Machining

Abrasive jet machining process is a mechanical machining process which uses the mechanical force of the abrasives to strike the work piece. The abrasives strike the work piece by a jet stream of abrasives, the abrasive stream makes dent on the work piece which erode the material from the work piece. The high speed stream of abrasives is produced by changing over the weight vitality of transporter gas or air to its Kinetic vitality and consequently the high speed fly. Spouts coordinate grating plane in a controlled way onto work material. Abrasive jet machining is used for the machining of Titanium, Brass, Aluminum, Stone, Any Steel, Glass, Composites. [1]

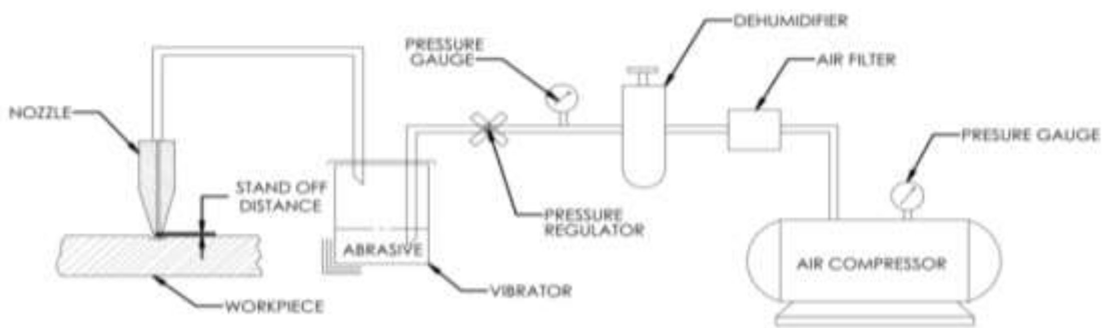

Figure 1: AJM Schematic Diagram [2, 3]

Process parameters of abrasive jet machining process:-[4]

1. Grating mass stream rate 2. Spout Tip Separation 3. Gas Pressure
4. Speed of rough particles 5. Blending proportion 6. Rough grain measure

Water Jet Machining

Water jet machining process is a mechanical machining process which uses the mechanical force of the Water to strike the work piece. The Water strike the work piece by a jet stream of Water, the Water stream makes dent on the work piece which erode the material from the work piece. It includes the utilization of high speed water fly to easily cut a delicate work piece. It is like Abrasive Jet Machining (AJM). In water stream machining, high speed water fly is permitted to strike a given work piece. [5]

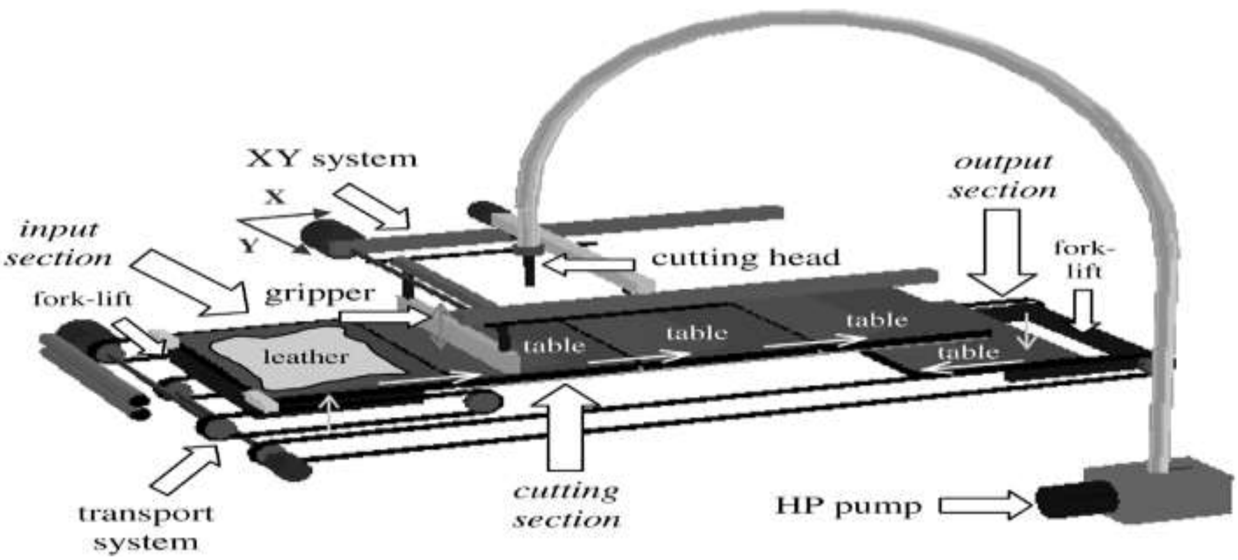

Figure 2: Schematic Diagram for WJM [5]

Process parameters of abrasive jet machining process: - [6]

1. Jet Nozzle 2. Jet Fluid 3. Work piece

Abrasive Water Jet Machining

Abrasive Water jet machining process is a mechanical machining process which uses the mechanical force of the Abrasive and Water to strike the work piece. The Abrasive and Water strike the work piece by a jet stream of Water, the Abrasive Water stream makes dent on the work piece which erode the material from the work piece. All grating plane frameworks utilize a similar essential two phase spout. In the first place, water goes through a little measurement gem hole to frame a thin jet. The rough particles are quickened by the moving stream of water and they pass into a long empty tube shaped fired blending tube. For the most part two kind of spout utilize, right edge head and straight head. [7]

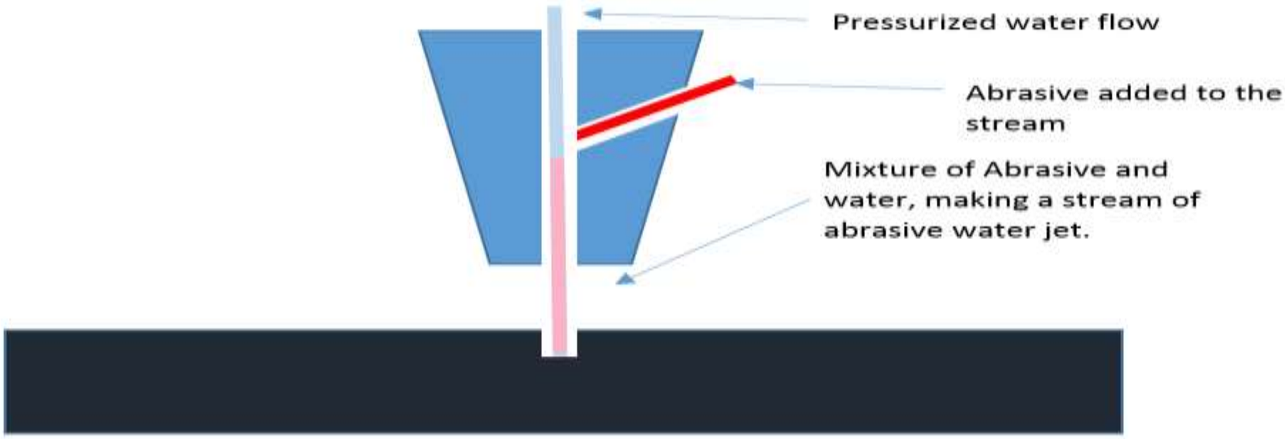

Figure 3: Working of AWJM [6]

Process parameters of abrasive jet machining process: - [8]

1. Grating mass stream rate 2. Nozzle Separation 3. Fluid Pressure
4. Speed of rough particles 5. Blending proportion 6. Rough grain measure

Laser Beam Machining

Laser Beam machining process is a thermal machining process which uses the thermal force of the laser beam to strike the work piece. The laser beam strike the work piece by a beam of laser, the Laser beam melts the work piece which erodes the material from the work piece. It is appropriate for geometrically complex profile cutting and making smaller than usual openings in sheet metal. LBM is a heating procedure. The adequacy of this process relies upon thermal properties and, to a certain degree, the optical properties as opposed to the mechanical properties of the material to be machined. [9]

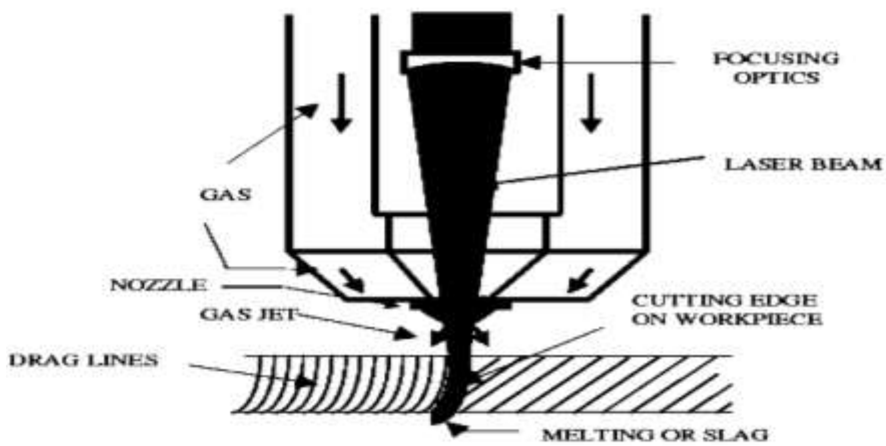

Figure 4: Working of LBM [9]

Process parameters of Laser beam machining process: - [10]

1. Pulse Energy 2. Pulse Duration 3. Pulsing
4. Spatial moldings 5. Assisting gases

Electron Beam Machining

Electron Beam machining process is a thermal machining process which uses the thermal force of the Electron beam to strike the work piece. The Electron beam strike the work piece by a beam of Electrons, the Electron beam melts the work piece which erodes the material from the work piece. Electron Beam is produced in an electron beam gun. Electron Beam Machining is required to be completed in vacuum. Generally the electrons would connect with the air atoms; along these lines they would free their vitality and cutting capacity. In this way the work piece to be machined is situated under the electron bar and is kept under vacuum. [10]

Confined warming by centered electron beam Expulsion because of high vapor weight.

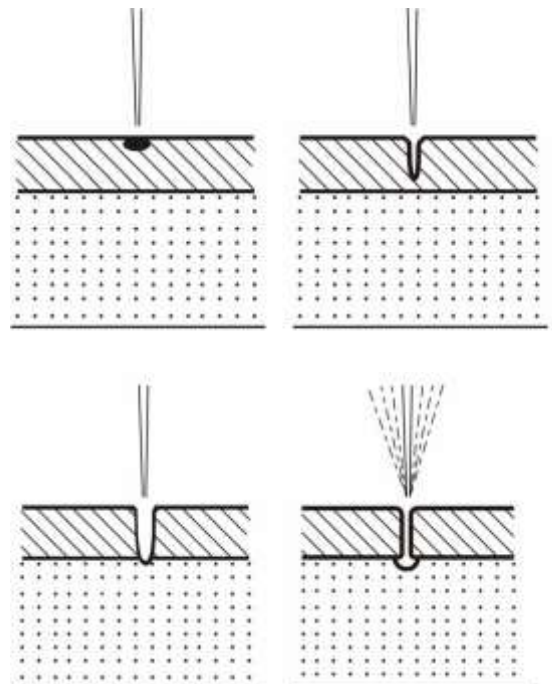

Figure 5: Working of EBM [10]

Process parameters of Electron beam machining process: - [10]

1. Quickening voltage 2. Beam current 3. Pulse Span

4. Energy per beat 5. Lens Current 6. Power thickness

COMMON PARAMETERS OF NON-TRADITIONAL MACHINING PROCESS

Surface roughness

The machine used to check the roughness value is Roughness Tester, which works on a tiny stylus and a Displacement Sensor. Measurement is done by movement of the stylus in a straight line which is parallel to the surface. The perpendicular displacements are recorded thereby giving an outline of the surface checked. If required for stimulation the profile obtained is then fed into the software to develop a Grid View or Speckle pattern of the part surface. This process is helpful for further analysis of the surface obtained after cutting or machining. [11]

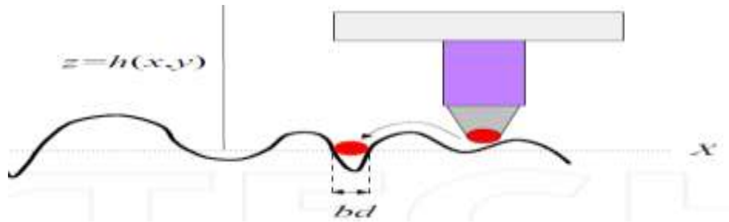

Figure 6: Diagram showing Measurement of roughness [11]

METAL REMOVAL RATE (MRR)

Metal removal Rate (MRR) is also a measure of the machine performance; MRR can be defined as the amount of metal removes from the surface of the work piece. The MRR is calculated in terms of the metal removed in unit time from the work piece. MRR is expressed in unit mm3/min. [12]

Formulae for MRR= $\frac{\text{Volume of metal removed}}{T}$

Where volume of metal removed is equal to the final volume of work piece subtracted from initial volume of work piece. And T is the time taken by the machine in minutes to cut the Work piece.

So the unit of MRR is mm^3/min.

EXPERIMENTATION

The research experiment can be done by taking a work piece of a suitable metal which can be used for most of the non- traditional machining process and using them to perform the experiment. The experiment can be done and observation can be taken by measuring the surface roughness of the work piece and the time taken by each machining process for the machining of the same material and same size work piece.

CONCLUSION

The result can be obtained by comparison of the experimental results obtained in the experiment and observing them. The comparison must be done by using a mathematical tool. This experimentation and comparison will provide a qualitative and quantitative analysis result of the performance of each non-traditional machining process on the material. So after this experiment a conclusion can be determined that a certain machining process is best suited for the particular material. So this experiment can be performed for various metals like mild steel, aluminum etc. to obtain various results. Moreover the experiment can be used to find out compromising solutions like combination of high surface roughness and average MRR and vice versa.

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