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Investigation Analysis and Demonstration of Swirl Type Polymer Composite Abrasive Mixing Chamber

Edwin Joy Pulikkottil[1], Emin George[2]
[1, 2]*Department of Mechanical Engineering, Anna University Chennai*

Abstract: ***Imparting good surface finish to a brittle work piece is one of the major problem faced in the manufacturing process. The limitations of present equipment gives the idea for a new systems for good surface finish and coating removal one of the techniques used to obtain good surface finish and coating removal is use of abrasive jet machining since it has an disadvantage of removing the useful material along with the unwanted material the surface finish is not good as desired. A polymer is a large molecule, or macromolecule, composed of many repeated subunits. Because of their road range of properties, both synthetic and natural polymers play an essential and ubiquitous role in everyday life. So the abrasive particles are mixed with polymer using chemical solvents and fed into a mixing chamber and blasted with the help of nozzle and tested the performance. First polymer and abrasives is selected to the required quantity. Then mix the abrasive and polymer manually or mixer machine with the help of chemical solvent. Then the polymer composites abrasives are made. Hence we propose a simple system where the polymer composites manually or mixer machine with the help if chemical solvent. Then the polymer composites abrasive are made. Hence we propose a simple system where the polymers and the abrasives are mixed with the help of the compressed air. The entire system is fully automated such that the involvement of manual work is very negligible***

Keywords: coating removal rate, abrasive jet machining, polymer, chemical solvents, nozzle, mixing chamber, compressed air.

I. INTRODUCTION

Rapid technology development in the field of new materials and alloys with increasing strength hardness, toughness, heat resistance have imposed many problems and difficulties during the machining by conventional means. Machining intricate and complicated shapes of this and fragile components and accurate and economical forming of very hard, high strength materials which are being extensively used in airplane and nuclear industries have force3d the scientist, engineers and technologists to search for new techniques of machining which can readily provide an effective solutions to these problems. Machining operations are made easy with the abr4asiuve materials but the mixing up of the abrasive material is still a tedious process.

Abrasive water jet machining (AWJM) process is a mechanical non-traditional machining process which uses abrasive particle and pressurized water for machining. In AWJM material removal in case of brittle material is due to the crack initiate by abrasive grain and its penetration into the material. Polymer composites find its application in various fields due to their high specific stiffness and strength. Polypropylene resins have good toughness and it is used in manufacture bullet proof vest and helmet. Compared to conventional drilling, AWJM gives an improved output results

As a research and development for the last forty years several new methods of mixing polymer abrasive have emerged. Among the new methods we are going to deal with one of the simplest methods. It consist of a mixing chamber, control unit, heater and a solenoid valve the operation of this system is fully automated such that the time consumption is also less and the consistency of the mixed up polymer abrasives is also same.

Using abrasive jet machining is the one of the process for removing unwanted surface from the work piece and removing coating. But one of the disadvantage of using this techniques is along with the unwanted material removal the useful material also got removed the surface finish obtained is not fine one. This is due to low resilience property of the abrasives so the polymers are mixed with abrasive to get resilience property and to get good surface finish to work piece and good coating removal rate. The limitations of commercial equipment raises the need for new systems for good surface finish and coating removal one of the techniques used to obtain good surface finish is not good as desired so the abrasive particles are mixed with polymers using chemical solvents and fed into a mixing chamber and blasted with the help of nozzle and tested the performance.

This polymer composites abrasive is fed into a specially designed nozzle unit. Then it is blasted on to the work piece. The work piece coating removal rate and surface finish is inspected.

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II. SCOPE OF THE INVESTIGATION

To obtain a system for higher surface finish and coating removal rate and investigate on it. Make various combinations of abrasives with polymer and investigate them. Design a mixing chamber for polymer composite abrasives. The proposed work aims at bringing about a system with preset targets of attaining superior finish and material removal rate. Furthermore, the effect of having various chamber which is best suited to meet the various requirements corresponding to the above system is designed.
Reduction of surface damage caused by abrasive jet blasting for coating removal rate and food surface finish to the work piece. Abrasive water jet cutting is a non traditional machining method that offers productive alternative to conventional techniques. It used a fine jet of ultra-high pressure water and abrasive slurry to cut the target material by means of erosion.

III. METHODOLOGY

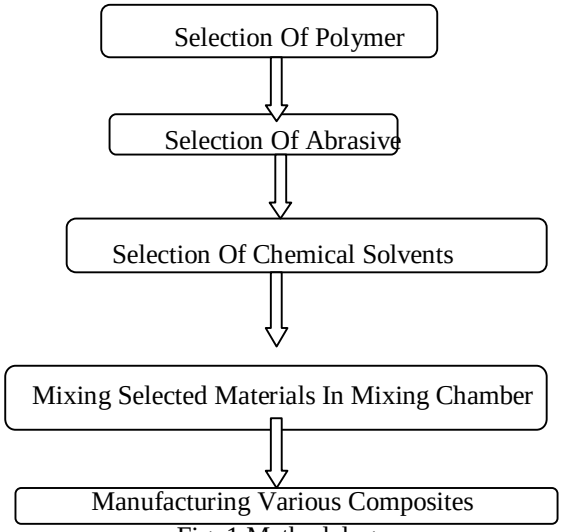


Fig. 1 Methodology

IV. PRINCIPLE

This process works on basic principle of water erosion. In this process, a high speed well concentrated water jet is used to cut the metal. It uses kinetic energy of water particle to erode metal at contact surface. The jet speed is almost 600 m/s. It does not generate any environmental hazards. For cutting hard materials, abrasive particles are used in water jet These abrasive particles erode metal from contact surface.

A. Abrasives
1) Silicon Carbide
2) Aluminium oxide
3) Copper slag
4) Glass Beads
5) Plastic Abrasives

B. Polymer
1) Poly ethylene
2) Poly dimethyl siloxane
3) Acrylonitrile butadiene styrene
4) Poly Styrene
5) Poly Proplene
6) Isoprene
7) Chloroprene
8) Nitrile Buta Diene
9) Styrofoam

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C. Chemical Solvents

1) Trichloro ethane
2) N-methyl-2-Pyrrolidone
3) Methyl Ethyl Ketone
4) Carbon disulphide
5) Ortho Dichlorobenzene
6) Acetone

D. Chemical Solvents used to Dissolve Polymer are Given Below

1) Poly styrene with carbon disulphide
2) Poly ethylene with 1,2,3 Trichlorobenzene
3) Poly propylene with O-Dichlorobenzene
4) Acrylonitrile butadiene styrene Ethyl methyl ketone.



Fig2. Abrasive materials

V. COMPONENTS OF MIXING CHAMBER

A. Main mixing chamber
B. Auxiliary mixing chamber
C. Control unit
D. Solenoid valve
E. Manifold
F. AC motor
G. Belt drive
H. Pulley
I. Frame



Fig3. Main mixing chamber

The mixing chamber used here is a cylinder 30 cm inner diameter and 50 cm length made of steel. Let is check whether the hoop stress lies within the allowable limit or not for safe working of the mixing chamber

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A. Ultimate hoop stress

Let,

P=intensity of pressure

D= Internal diameter of the cylinder

L=length of cylinder

T=Thickness of cylinder

Ft=ultimate hoop stress in the cylinder material

Factor of safety =2

Therefore allowable hoop stress

Using the Relation

Ft=PD/2Ft

B. Power of motor

Power of the motor is calculated theoretically to know the power required for motor to make the vibration of the mixing chamber for proper mixing of polymers and abrasives.

$$P = \frac{2 \times \pi \times NT}{60}$$

VI. CONCLUSION

The study on the existing model is done and found that the excess use of mechanical components can make the mixing chamber wear off quickly. To prevent the excessive wear of the mixing chamber. The rack and pinion mechanism is substituted by electronic and pneumatic system. The control unit controls the air flow and the flow of abrasives is designed carefully the model of the mixing chamber is made using Catia V5 software.

The study and performance of mixing chamber done and found that the polymer that diffuses in solvent up to 50 degree can be mixed in this mixing chamber. If the temperature more it will melt the plastic tubes inside the mixing chamber.

The advantage of using this mixing chamber is the mixing can be made easily and the cost of the machine is less. But it has high sound and cannot use for polymer that diffuses with solvents at high temperature. The maintenance cost of this machine is also less. The operators should frequently check the machine. Since it involves electrical and mechanical components the operator should use this machine carefully.

Aluminium oxide with polystyrene and Aluminium oxide with poly ethylene are to be tried out.

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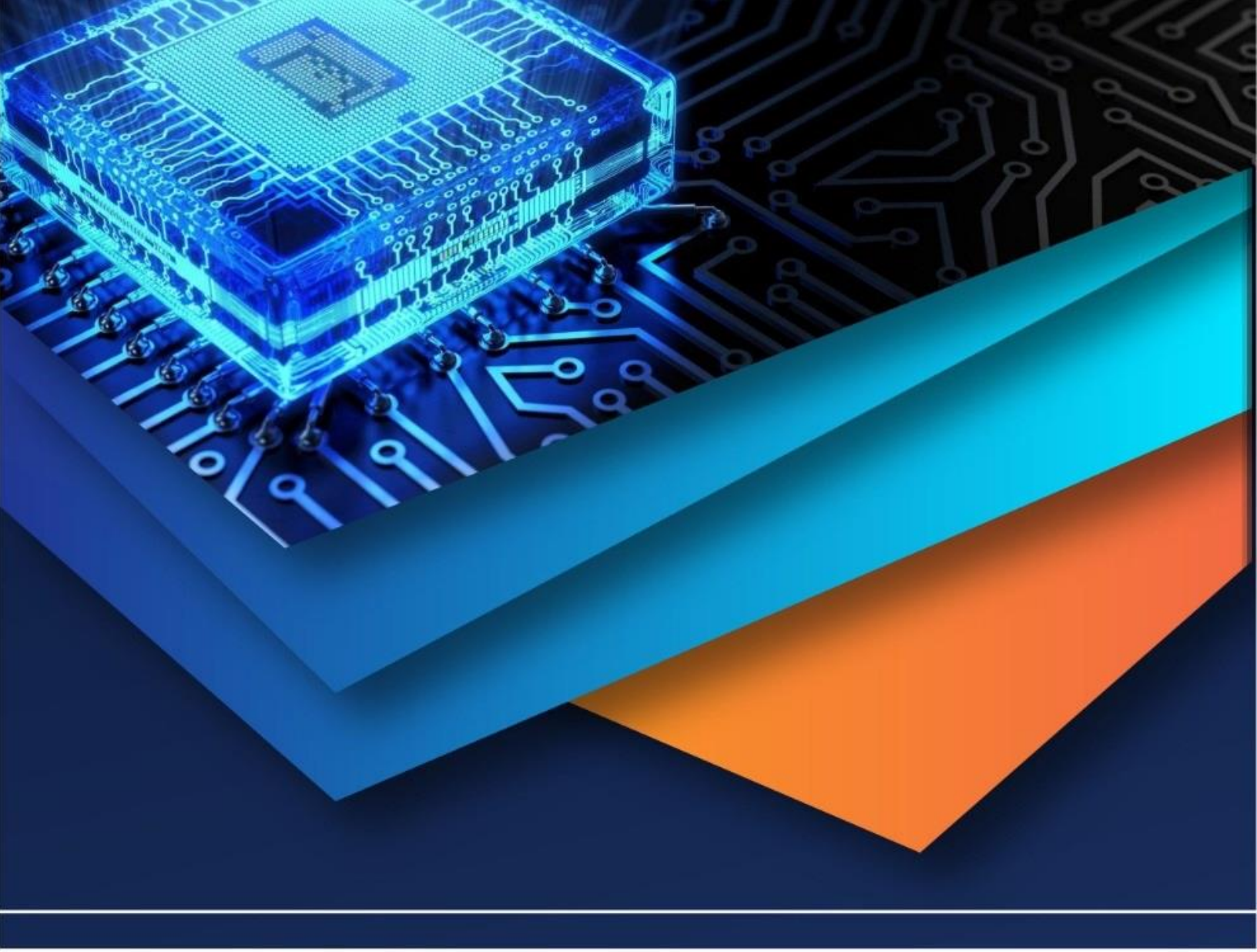
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