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Powder Mixed Electric Discharge Machining of Hastelloy

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Abstract: ***The main goal of the project is to research and analyze the surface finishing of Hastelloy and surface Modification by electrical discharge coating. Machining is done by Electric Discharge Coating processes using EDM Oil as the dielectric liquid and copper as the electrode. The conventional EDM oils are kerosene, paraffin and transformer Oil extracted from petroleum oil. Electric discharge coating (EDC) is an emerging surface modification Technology to create such hard coatings by using electrical discharges to apply a layer of material to a workpiece Surface to modify and enhance surface properties or create new surface features. The analysis report of this project includes peak current, pulse duration (TOn) and tip wear rate (EWR). Material Removal Rate (MRR), Tool Wear Rate (TRR) and Surface Roughness (Ra), Discharge Voltage, Duty Cycle and the weight of the workpiece before and after machining.***
Keyword: Hastelloy; Dielectric; Modification; MRR; TWR; Ra

I. INTRODUCTION

Electric Discharge Machining, also known as Spark Machining, spark eroding, die sinking, wire burning or similar wire EDM, is a metal fabrication process in which the desired shape is obtained by electric discharges. That process of the erosive action of electric discharge was discovered by an English physicist Joseph Priestley in the year 1770. 1943 Soviet scientists B. Lazarenko and N. Lazarenko came up with the idea of exploiting the destructive effect of electric discharge and developing a controlled process of machining materials that are conductors of electricity. With this idea, the EDM idea was born. The Lazarenkos perfected the electric discharge process, which consisted of a sequence of Discharges that take place between two conductors separated from each other by a non-conductive film liquid called the dielectric. The Lazarenkos achieved a Form of immortality with this circuit made today bears her name. Today, many EDMs use an extended version of the Lazarenko circuit. Electrical Discharge Metal Machining (EDM) is a popular unconventional process Machining Approach This is commonly used on hard Materials. This method is popular since the EDM can process any material independently of this its hardness. Modern engineering materials that are used in extreme conditions are often shaped or modified with the EDM process. But this process has its disadvantages. Lower material removal rate and Severe tool wear can often impede machining efficiency in this process.

II. MATERIAL AND METHODS

This entire process of electrical discharge machining is with EDM 5530. It is also called a cavity Type EDM or volume EDM, which consists of one electrode and workpiece in an insulating liquid such as e.g like, typically oil or more rarely other dielectrics Fluid.

Automation Grade: AutomaticVoltage: 380V
Phase: 3
Brand / Make: VSL
Work Table Dimension: 800*500*300 mmRepeat Positioning Accuracy: 0.005 mm

A. Procedure Methodology

This machining process uses electrical sparks to remove metal from the workpiece. This edit is the same as Removing metal burrs in the presence of an electric spark used as a cutting tool for cutting the workpiece and creating the desired shape. This process takes place through the application of high-frequency current to work through the electrode Piece. The spark product removes metal in the form of very small chips. This process is carried out in a dielectric Fluid. The EDM machining process continues the basic principle of spark generation and metal Removal by spark erosion. EDM spark erosion is the same as an electric spark burning a small hole in a piece of metal with which it comes into contact. The resulting spark The process generates heat, which removes metal through erosion and evaporation. in this editing process, both the workpiece and the tool should be made of conductive material.

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B. Statistical Analysis

Experimental investigation of jatropha curcas bio-oil and biodiesel in electric discharge machining of Ti- 6Al-4V: S.M.Bashaab & H.K.Davea & H.V.Patela

Electric Discharge Machining (EDM) is a thermal energy-based advanced machining process used to process all electrically conductive materials regardless of their physical properties such as strength and Hardness. Material removal is generally due constant return of the electrons from the cathode to the anode. Dielectric is an unavoidable Component in the EDM process where there is a significant impact on machining properties such as Material Removal Rate (MRR), Tool Wear Rate (TWR) and End Wear Ratio (EWR). organic oil/organic Diesel based dielectric fluids are suitable substitutes for conventional hydrocarbon dielectric fluids that are carcinogenic. In this present work, jatropha bio-oil and biodiesel are used to control their Power to machine Ti-6Al-4V with the EDM Process. An experimental design is applied to Taguchi Find out the combination of the optimal process Parameters that arise to obtain the maximum MRR and EEA and minimum TWR. analysis of variance (ANOVA) is performed to know the significance level of each process parameter in response characteristics. Based on ANOVA, independent of the Dielectric used for machining, it is found that Current is the only significant parameter for MRR, TEA and EEA.

III. APPLICATIONS

Cutting of extremely hard conductive materials that can prove challenging on conventional machining methods.

1) lEDM machining provides a very smooth finish, with burrs or rough patches. So EDM is an excellent choice when finish or appearance matters in the final product.
2) Drastic reduction in production time and unit cost and also provides increased throughput from the machine.
3) The precision inherent in the EDM process allows complex designs to be machined cost-effectively.
4) EDMs come with inbuilt precision and accuracy which cost-effectively allows machining of complex designs.

IV. DISCUSSION

A. Material Removal Rate (MRR)

Material Removal Rate, the abbreviation of MRR is usually defined as the amount of material that is removed per unit of time. The term MRR is considered very important as it defines whether the machining rate is fast or slow.

B. Tool Wear Rate (TWR)

Tool Wear rate, the abbreviation of TWR is usually defined as the gradual failure of the tool because of its operations. Here the Tool Wear Rate is also taken as an important aspect as it determines the surface finish of the workpiece. The main purpose of this concept is to obtain a minimum Tool Wear Rate.

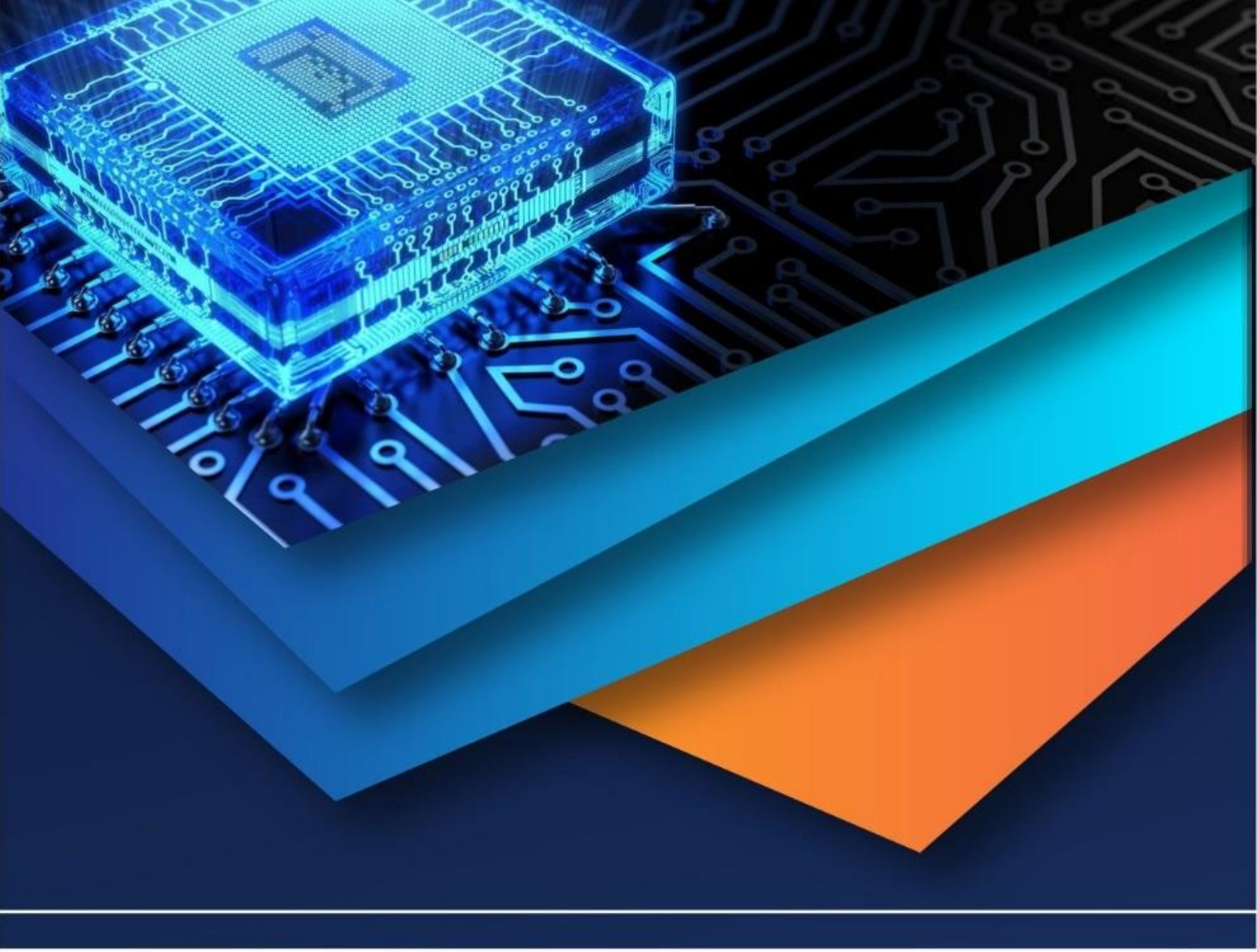
C. Surface Roughness (Ra)

Surface Roughness, the abbreviation of Ra is defined as the texture of the workpiece or the topography of the workpiece after the machining is done. The MRR and TWR are considered important aspects for the cause of acquiring good Surface Roughness.

V. CONCLUSION

In this project, we are implementing a method of coating one material over another. EDM method is used for this machining process as the cost of the EDM machining is lesser than that of the traditional coating process. The report analysis is done that includes the readings along with graphical representations of MRR, TWR, and Ra.

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