International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

A Review Paper on Experimental Investigation for MRR & Surface Finish in Electrical Discharge Machine using Different Tools on AISI316

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ABSTRACT:-*Electric discharge machining (EDM) is a material removal process that is especially useful for difficult-to-cut materials with complex shapes and is widely used in aerospace, automotive, surgical tools among other fields. EDM is one of the most efficient manufacturing processes and is used to achieve highly accurate production. It is a non-contact thermal energy process used to machine electrically conductive components irrespective of the material's mechanical properties. Studies related to the EDM have shown that the process performance can be considerably improved by properly selecting the process material and operating parameters. This project reviews experimentation on the application of EDM to AISI316 grade of stainless steel material using various electrodes/tools and describe experimental and theoretical studies of EDM in which we attempt to monitor and asses the process performance, by considering material removal rate, surface quality and tool wear rate among the selected tools. In addition, this report is based on examining models and techniques used to determine the EDM process parameters. This project also presents a discussion on the optimal tool material that can be used to machine the selected workpiece material i.e. AISI316 and ideas for better results that outlines the likely trend for future research.*

***Key Words*:-** Electro discharge machine, Dielectric, Electrodes, AISI316, Material Removal Rate, Surface finish.

1. INTRODUCTION

In recent years we have witnessed a great boom in the use of non-conventional manufacturing methods, the industries are running after the advanced industrial applications. Also it is observed that AISI316 which is an austenitic stainless steel, has a very wide range of application in various industry. Thus using EDM for machining the steel can be an option.

The fundamental principles of the EDM process are applied in many processes, including: die-sinking EDM, wire EDM, micro-EDM, powder-mixed EDM and dry EDM. These variants make the process suitable for machining components from the relatively large to the micro-scale. The EDM process has advantages over other machining processes. EDM can machine complex shapes and extremely hard materials as described in a number of publications. The EDM can be used to machine very small, delicate and fragile products without damage because no cutting forces are applied and hence there are no mechanical induced residual stresses. However, EDM has its own limitations with regards to the workpiece material and shape. At present EDM can only be applied on electrically conductive materials. The process has low material removal rate and high electrical power consumption.

Furthermore, additional cost is incurred preparing the electrode tool in case of the die-sinking EDM. Finally, sharp corners are difficult to produce using EDM because of electrode tool wear. While many studies have reviewed EDM, wire EDM and other EDM processes, no study has reviewed and reported on the use of EDM for machining of stainless steel specifically, though there are many reviews available on other materials machined by EDM. This study aims to provide an overview of the significant contributions of EDM to the machining of Austenitic stainless steel.

2. PROBLEM STATEMENT

In recent years, the rapidly rising demand for materials with special characteristics in such advanced industrial applications as aerospace and surgical instruments, has led to the development of new materials. However, these materials are mostly difficult-to-cut using more conventional manufacturing processes and this pushes manufacturers to explore new machining processes which maintain or even improve precision but at reasonable cost.

Stainless steel is one of the widely used difficult-to-cut materials because of its superior properties which combine good corrosion and chemical reaction resistance, with the ability to be easily cleaned, polished and sterilized. New stainless steel compositions are developed to meet the need for higher corrosion resistance, increased strength and elevated temperature resistance. About 150 separate and distinct compositions of stainless steels already exist. These compositions include grades 304, 305 and 316, each of which was developed to meet a specific end-use and each of which in common with most stainless steels contain common alloying ingredients, such as chromium, nickel or molybdenum.

Electric discharge machining (EDM) is one of the most advanced and successful manufacturing methods used to machine materials that are difficult-to-cut. EDM is being used in modern industries to facilitate complex machining processes and achieve highly accurate machining. EDM is

utilized to remove material from a conductive workpiece by repetitively applying sparks between the EDM electrode tool or wire and the workpiece. In this process, no mechanical cutting forces are applied because no contact exists between the electrode tool and the workpiece. The fundamental principles of the EDM process are applied in many processes, including: die-sinking.

The EDM process has advantages over other machining processes. EDM can machine complex shapes and extremely hard materials as described in a number of publications. The EDM can be used to machine very small, delicate and fragile products without damage because no cutting forces are applied and hence there are no mechanical induced residual stresses. However, EDM has its own limitations with regards to the workpiece material and shape.

This project aims to provide an overview of the significant contributions of EDM to the machining of Stainless Steel AISI316. This project reviews the research studies that uses different tool materials variants for machining different types of steel materials.

3. OBJECTIVES

The project objective is to carry out the experimentation and obtain the relevant data which will allow us to come to a conclusion about the best combination of tool material and EDM parameters to achieve the best results for the AISI316 Austenitic Stainless steel workpiece material.

The objective is to examine:

- Better Material Removal Rate
- Better Surface finish
- Least Tool Wear Rate

The project, as mentioned, is an experimentation based project, thus our goal is to obtain maximum knowledge from the research and utilize the same in our project in future.

4. WORK PLAN

The project will be undertaken with the following methods:-

1. Literature study - Study of related literature on mechanical and thermal properties of tool materials and workpiece material AISI316.

2. Comparative analysis of various tool materials – A comparative and theoretical study of various tool materials (e.g. Silver) will be carried out in order to come up with most appropriate results.

3. Setting up a specific dimension of workpiece – In order to obtain a justified result, the dimension of the workpiece is to be fixed.

4. Machining – The same dimension of AISI316 material will undergo electric discharge machining with different tool materials.

5. Result comparison and Analysis – The MRR and Surface finish obtained by each tool material will be compared experimentally and these results will be analysed to bring up possible improvements.

5. CONCLUSION

Up till now all the necessary information for performing the experiment is gathered. Also we have decided the dimensions and parameters for the tools and work-piece. The decisions were made on the basis of our industrial interactions and by the guidance of our Industrial Guide along with our theoretical study. The review made us reach to a conclusion that there's a particular value of parameters that can be considered in order to reduce the extra efforts. These parameters will be the one that are generally used in the industry. The work plan is all set, and the implementation will be done in the next phase and the final conclusion will be reached.

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