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Optimization of process parameter in Electrical Discharge Machining process via Taguchi method

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ABSTRACT

Electrical Discharge Machining employs a variety of techniques to increase the rate of tool and material removal by utilising various electrode combinations and electrode configurations. While machining, the machining parameters, on the other hand, are also effective. MRR and TWR responses, as well as discharge current (IP) and pulse on time (Ton), are all being investigated in this experiment to see if they have any effect on MRR and TWR responses. The aluminium alloy 5083 was chosen as the workpiece for this Copper electrode because it is commonly found in a wide range of everyday products, including food containers. Because of its effectiveness in reducing the number of parameter variations through the robust design of experiments, the Taguchi method has been called "the gold standard" (DOE). It was necessary to experiment with an L9 orthogonal array to complete the runs. To maximise MRR while minimising TWR, it is necessary to optimise the EDM process. The pulse on and Pulse off time is 30% above in effect of TWR. The ability of an industry to produce high-quality products at a low cost is dependent on the ability of that industry to make the most efficient use of a given situation or resource.

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1. Introduction

The electrical discharge machining (EDM) technique is the most fundamental of the non-traditional machining methods. In this method, the spark's heat energy removes material from a workpiece by a series of electrical ejections from an electrode [1,2]. EDM is a type of machine tool that is commonly used in the automotive, aerospace, and die-making industries to machine electrically conductive hard metals and alloys [3]. Debris can be removed from the tool surface using the EDM method and A repeating electrical expulsion between the tool (cathode) and the workpiece (anode) material moulds the tool surface into a metal part. Anodes and cathodes are used to describe these two electrodes in this machining process because they are connected to the terminals of an electromagnet on opposing sides of the magnet's field line. Kerosene, transformer oil, distilled water, and other dielectric fluids are examples of dielectric fluids [4–6]. Critical process output is the rate of material removal (MRR), which is followed by the rate of tool wear (TWR) [7,8]. Copper electrodes are used in this paper to investigate the possibility of optimising the EDM process [9]. The goal of optimising the EDM process is to maximise MRR while reducing TWR as much as possible. The Taguchi technique was used to create the experimental design for this project. With the help of Analysis of Variance, we were able to determine the S/N Ratio of the response.

2. Experimental work

Since the spark discharge between the tool and the workpiece is maintained by a servo system, erosion of the workpiece occurs as a result of the rapid recurrence of the spark gap between the two [10]. In most cases, the EDM process does not affect the heat treatment that is performed beneath the surface because the spark always occurs in dielectric fluid or kerosene. The experiments are carried out using a SPARKONIX, an Electrical Discharge Machine because the electrode and workpiece are polarised in the opposite directions of the electrode (as shown in Fig. 1) here, Kerosene

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