Research Paper

EFFECT OF MIXTURE OF AL AND SIC POWDER ON SURFACE ROUGHNESS IN PMEDM USING TAGUCHI METHOD WITH GRA OPTIMIZATION

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ABSTRACT.

Powder mixed electro-discharge machining (EDM) is being widely used in modern metal working industry for producing complex cavities in dies and moulds which are otherwise difficult to create by conventional machining route. It has been experimentally demonstrated that the presence of suspended particle in dielectric fluid significantly increases the surface finish and machining efficiency of EDM process. Concentration of powder (Aluminum + Silicon carbide) in the dielectric fluid, pulse on time, duty cycle, gap voltage and peak current are taken as independent variables on which the machining performance was analyzed in terms of surface roughness (SR). Experiments have been conducted on a ZNC control EDM machine manufactured by Electronica Machine Tools Ltd. India. A copper electrode having diameter of 30 mm is used to finish AISI D3 steel for to get depth of 0.5mm.The proportion of the powder is 1:1. Oil quantity 10 lit. Flow rate 5 lit/min Taguchi method with GRA optimization is adopted to study the effect of independent variables on responses and develop predictive models. Aim of this experimentation is to find the range (level) of parameters to get the good surface finish

KEYWORDS: Powder mixed EDM; surface roughness; GRA.

INTRODUCTION

Electrical discharge machining (EDM) is an extensively used non-conventional material removal process to machine electrically conductive and hard materials for manufacturing of mould, die, automotive, aerospace and surgical components.(1)In this process, material is removed by controlled erosion through a series of electric sparks between the tool (electrode) and the work piece. The thermal energy of the sparks leads to intense heat conditions on the work piece causing melting and vaporizing of work piece material. Sometimes it's low machining efficiency and poor surface finish restricts application. To diffuse this problem, EDM in the presence of powder suspended in the dielectric fluid is used and known as powder mixed EDM (PMEDM). The electrically conductive powder reduces the insulating strength of the dielectric fluid and increases the spark gap between the tool and work (4)

As a result, the process becomes more stable for and thereby and surface finish (SF). The presence of powder increases the gap distance as compared to traditional EDM by at least a factor of two. The enlarged and widened discharge channel lowers the break down strength of the dielectric fluid and reduces the electrical density on the machining spot. By reducing the spark energy and dispersing the discharges more uniformly throughout the surface.

LITERATURE REVIEW:

Based on the literature review carried out, the contribution to the research pertaining to PMEDM is as discussed below.

H.K. Kansal, Sehijapal Singh [1] has shown the technology & research developments in PMEDM. This paper helps for getting the enhancement capabilities of Powder Mixed Electric Discharge Machining. Y. Uno, Avocado and S.Cetin et.al [2] has shown the effect of using various elements like **Parameters:** current=3A, duty factor= 10%puls duration=2µs**Powders Used:** nickel powder: less than5µm in size, Concentration: 40g/l, He studied the response variables like surface wear resistance, Surface Roughness. S. Assarzadeh& M. Ghoreishi [3] has shown the effect of using various parameters**:** Discharge current (I) 5–11A, Pulse-on time (Ton) 50–150 µs,Source voltage 50–70 Duty factor 0.5,**Powders Used:** Al_2O_3 powder, density 2.9 g/cm^3.He studied the response variables MRR and surface roughness (Ra). He concluded that Suspending Al_2O_3 fine abrasive powders into the dielectric oil of Electric discharge machining machine produces more widened gap compared to the pure case which in turn facilitates flushing action and avoids process instability. Improves the surface roughness & MRR. Sukhpal S. Chatha, Rakesh Bhatia [4] has shown the effect of using various parameters**:** voltage 110 V ,Working time 75 minutes, Tool size (diameter) 19 mm Polarity: Positive, Ton 6µs Powder Used: Titanium dioxide. He studied the various response variables Material Removal Rate, Surface roughness, Surface hardness, Recast layer. They conclude that the MRR increases with the increase of TiO2 powder concentration into the dielectric. This trend is valid up to a certain limit further increase of titanium dioxide concentration leads to decrease of MRR. Addition of TiO2 powder into dielectric fluid reduces the surface roughness in comparison to conventional Electric discharge machining process. The micro hardness increases with the increase in powder concentration and still higher value of hardness can be achieved at higher concentration levels. Paulo Pecas& Elsa Henriques [5] have shown the effect of various parameters**:** Electrode penetration: 0.5mm, duty cycle: 50% current=2-8A **Powders Used:** Titanium Dioxide. He studied the various response variable analyses of the electrode area, SR, Craters morphology, Surface topography, and Surface roughness

GRA Optimization

The Grey theory established with Grey relational analysis, Grey modeling, prediction and decision making of a system in which the model is unsure or the information is incomplete. It provides an efficient solution to the uncertainty, multi-input and discrete data problem. The relation between machining parameters and machining performance can be found out using the Grey relational analysis. And this kind of interaction is mainly through the connection among parameters and some conditions that are already known. (6)

Also, it will indicate the relational degree between two sequences with the help of grey relational analysis. This theory is adopted for solving the