

# Studies on Recast-layer in EDM using Aluminium Powder Mixed Distilled Water Dielectric Fluid

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**Abstract**—In this paper, an attempt has been made to study the effect of aluminium powder when mixed in the distilled water dielectric fluid. The work and tool electrode materials used are W300 die-steel and electrolytic copper respectively. Pulse peak current, pulse on-time and concentration of aluminium powder are taken as the process parameters. The output response considered is white layer thickness (WLT). The experiments are planned using face centered central composite design procedure. Empirical model is developed for WLT using response surface methodology (RSM) to study the effect of process parameters. Optical microscopy results show that low thickness of white-layer 17.14  $\mu\text{m}$  is obtained at high concentration of powder of 4 g/l and low peak current of 6 A.

**Keyword**-PMEDM, Distilled water, Al powder, W300 die-steel, white-layer

## I. BACKGROUND

Powder Mixed Electric Discharge Machining (PMEDM) is one of the techniques used in EDM to improve the machining efficiency and surface finish in the presence of powder suspended dielectric fluid. Electrically conductive powder suspended in the dielectric fluid reduces the insulating strength of the dielectric and increases the spark gap between the tool and workpiece. As a result, the process becomes more stable, increases machining efficiency and reduces the surface defects.

The working principle of PMEDM is different from conventional EDM. A series of voltage pulses of magnitude about 20-120 V and frequency on the order of 5 kHz is applied between the two electrodes, which are separated by a spark gap typically 10-200  $\mu\text{m}$ . The spark gap filled up with powder particles suspended in the dielectric fluid, get energized due to the electric field. These charged particles are accelerated by the developed electrical field and act as conductors. The powder particles arrange themselves under the sparking area and gather in clusters. The chain formation of particles helps in bridging the gap (Fig. 1b) between the electrodes and decreases the insulating strength of the dielectric fluid. This results in several discharging paths creating multiple discharges within a single input pulse [1]. Thus a single input pulse creates several discharging

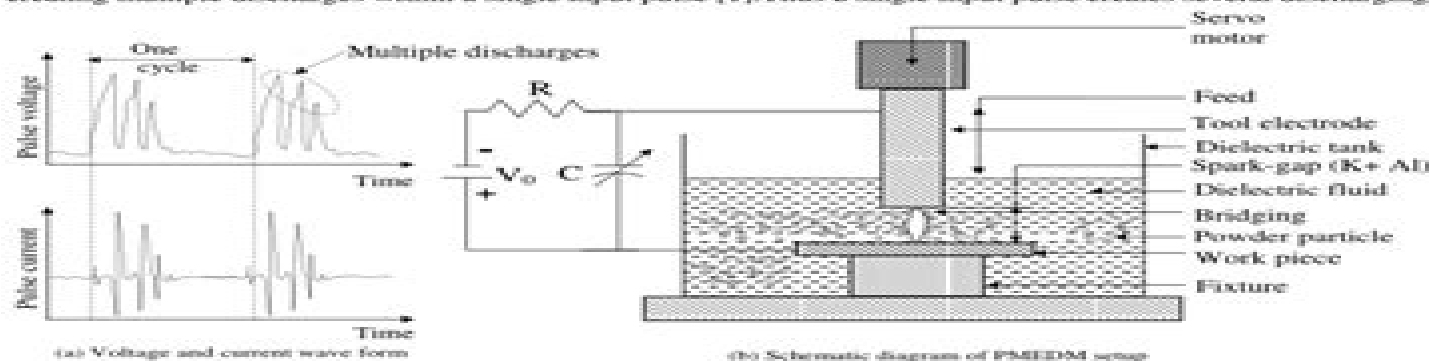


Fig. 1 PMEDM principle

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Engineered Materials Abstracts ,1992 Thomas' Register of American Manufacturers ,1996 Surface Modification of Aluminum by Edm Using Tic/Cu Electrode Abhishek Das,2010-08 Objective is to modify the surface of aluminum workpiece by electro discharge machining EDM process using TiC Cu green compact tool electrode Surface modification by EDM process is a newly invented fairly cheap and very competitive technique as compared to other surface modification techniques such as Physical Vapor Deposition PVD Chemical Vapor Deposition CVD and so on By using ordinary EDM machine tool and dielectric a very hard layer of the desired material can be created successfully Powder metallurgy P M green compact or semi sintered tool electrodes are used to create hard layer s on the work surface by transferring the constituent materials of the tool electrode on it in the form of a deposited layer which will enhanced mechanical and tribological properties and surface integrity The resulting coated surfaces have higher hardness corrosion resistance and wear resistance and less cracks Box Behnken approach of Response Surface Methodology RSM used to investigate the effects of the various process parameters Using the powder metallurgy green compact TiC Cu tool electrode a hard layer of 2325 HV has been created about 60 layer thickness Study the Applied Voltage and Wire Speed Influences on Machining Aluminium Alloy 6061 Using Wire-EDM Process Boon Aik Tan,2013

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