

# 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

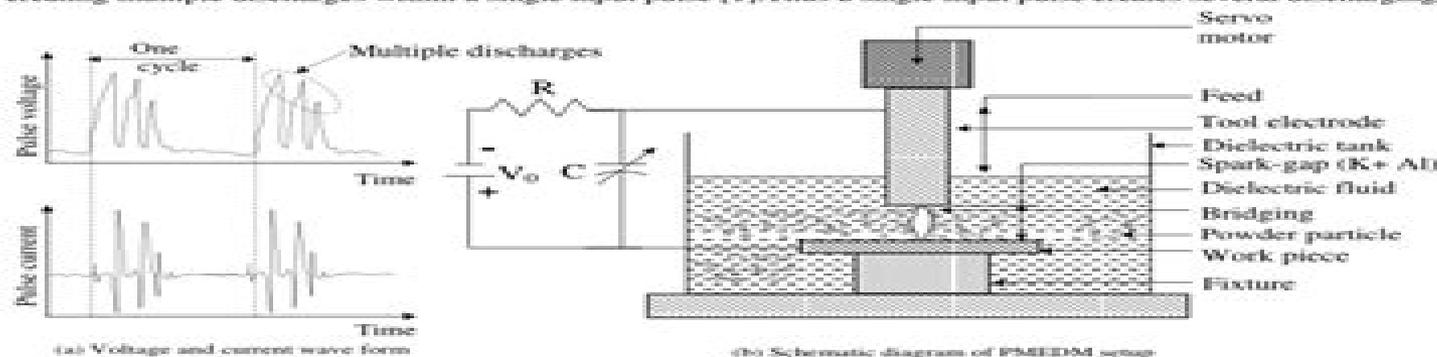


Fig. 1 PMEDM principle

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## **Table of Contents Studies On Recast Layer In Edm Using Aluminium Powder**

1. Understanding the eBook Studies On Recast Layer In Edm Using Aluminium Powder
  - The Rise of Digital Reading Studies On Recast Layer In Edm Using Aluminium Powder
  - Advantages of eBooks Over Traditional Books
2. Identifying Studies On Recast Layer In Edm Using Aluminium Powder
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Studies On Recast Layer In Edm Using Aluminium Powder
  - User-Friendly Interface
4. Exploring eBook Recommendations from Studies On Recast Layer In Edm Using Aluminium Powder
  - Personalized Recommendations
  - Studies On Recast Layer In Edm Using Aluminium Powder User Reviews and Ratings
  - Studies On Recast Layer In Edm Using Aluminium Powder and Bestseller Lists
5. Accessing Studies On Recast Layer In Edm Using Aluminium Powder Free and Paid eBooks
  - Studies On Recast Layer In Edm Using Aluminium Powder Public Domain eBooks
  - Studies On Recast Layer In Edm Using Aluminium Powder eBook Subscription Services
  - Studies On Recast Layer In Edm Using Aluminium Powder Budget-Friendly Options

6. Navigating Studies On Recast Layer In Edm Using Aluminium Powder eBook Formats
  - ePub, PDF, MOBI, and More
  - Studies On Recast Layer In Edm Using Aluminium Powder Compatibility with Devices
  - Studies On Recast Layer In Edm Using Aluminium Powder Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Studies On Recast Layer In Edm Using Aluminium Powder
  - Highlighting and Note-Taking Studies On Recast Layer In Edm Using Aluminium Powder
  - Interactive Elements Studies On Recast Layer In Edm Using Aluminium Powder
8. Staying Engaged with Studies On Recast Layer In Edm Using Aluminium Powder
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Studies On Recast Layer In Edm Using Aluminium Powder
9. Balancing eBooks and Physical Books Studies On Recast Layer In Edm Using Aluminium Powder
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Studies On Recast Layer In Edm Using Aluminium Powder
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Studies On Recast Layer In Edm Using Aluminium Powder
  - Setting Reading Goals Studies On Recast Layer In Edm Using Aluminium Powder
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Studies On Recast Layer In Edm Using Aluminium Powder
  - Fact-Checking eBook Content of Studies On Recast Layer In Edm Using Aluminium Powder
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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