

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 μm 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 μm . 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

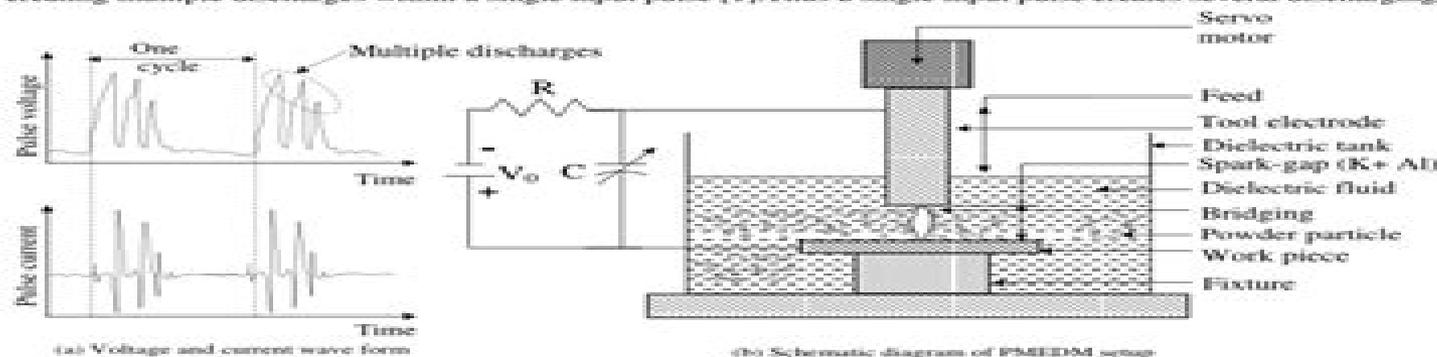


Fig. 1 PMEDM principle

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Handbook of Research on Advanced Functional Materials for Orthopedic Applications Ranjith, R.,Davim, J. Paulo,2023-08-29 Scaffold bone replacements are a safe and effective way to cure bone abnormalities and porous scaffolds can be manufactured using additive manufacturing technology When scaffolds are implanted in a damaged location they quickly connect to the host tissue and integrate stimulating bone production and development The qualities of porous titanium must be matched to the properties of human bones i e age sex and hormones Using subtractive manufacturing it is extremely difficult to create the complicated porous structure necessary for the desired characteristic The Handbook of Research on Advanced Functional Materials for Orthopedic Applications highlights current research pertinent to the orthopedic applications of additive produced scaffolds in order to consider the latest breakthroughs in the synthesis and multifunctional applications of scaffolds Covering key topics such as tissue additive manufacturing and biomaterial this major reference work is ideal for industry professionals engineers researchers academicians practitioners scholars instructors and students

Advances in Micro and Nano Manufacturing and Surface Engineering M. S. Shunmugam,M. Kanthababu,2019-11-30 This volume presents research papers on micro and nano manufacturing and surface engineering which were presented during the 7th International and 28th All India Manufacturing Technology Design and Research conference 2018 AIMTDR 2018 The papers discuss the latest advances in miniature manufacturing the machining of miniature components and features as well as improvement of surface properties This volume will be of interest to academicians researchers and practicing engineers alike

Advances in Engineering Research and Application Duy Cuong Nguyen,Ngoc Pi Vu,Banh Tien Long,Horst Puta,Kai-Uwe Sattler,2022-01-12 This book covers the International Conference on Engineering Research and Applications ICERA 2021 which took place at Thai Nguyen University of Technology Thai Nguyen Vietnam on December 1 2 2021 and provided an international forum to disseminate information on latest theories and practices in engineering research and applications The conference focused on original research work in areas including mechanical engineering materials and mechanics of materials mechatronics and micromechatronics automotive engineering electrical and electronics engineering information and communication technology By disseminating the latest advances in the field the Proceedings of ICERA 2021 Advances in Engineering Research and Application helps academics and professionals alike to reshape their thinking on sustainable development

Recent Advances in Material, Manufacturing, and Machine Learning Rajiv Gupta,Devendra

Deshmukh,Awanikumar P. Patil,Naveen Kumar Shrivastava,Jayant Giri,R.B. Chadge,2023-05-26 The role of manufacturing in a country s economy and societal development has long been established through their wealth generating capabilities To enhance and widen our knowledge of materials and to increase innovation and responsiveness to ever increasing international needs more in depth studies of functionally graded materials tailor made materials recent advancements in manufacturing processes and new design philosophies are needed at present The objective of this volume is to bring together experts from academic institutions industries and research organizations and professional engineers for sharing of knowledge expertise and experience in the emerging trends related to design advanced materials processing and characterization and advanced manufacturing processes

Electric Discharge Hybrid-Machining Processes Basil

Kuriachen,Jose Mathew,Uday Dixit,2022-03-30 This book provides the knowledge and insight into the fundamental aspects of Electric Discharge Machining EDM processes and various hybrid machining technologies derived to improve the machining efficiencies Fundamental theory of material removal recent research trends and future research directions have been covered in each chapter After explaining EDM Dry and Near dry EDM processes Electrochemical Spark Machining Arc Machining processes Electric Discharge Hybrid Turning processes Electrical Discharge Grinding Electric Discharge Milling and various assisted EDM processes have been discussed Finally modeling and simulation of hybrid machining processes are also included The book reflects the recent developments and trends in electric discharge hybrid machining processes It covers in detail the basics of EDM various hybrid and assistive technologies in EDM It includes the updated discussion on the significance of process parameters in various hybrid EDM processes An overview of modelling and simulation of hybrid EDM process is provided This book is aimed at Graduate students researchers in manufacturing engineering production engineering and materials engineering

Advances in Manufacturing Engineering and Materials II Sergej Hloch,Dagmar

Klichová, Frank Pude,Grzegorz M. Krolczyk,Somnath Chattopadhyaya,2021-03-16 This book reports on cutting edge research and technologies in the field of advanced manufacturing and materials with a special emphasis on unconventional machining process rapid prototyping and biomaterials It gathers contributions to the International Conference on Manufacturing Engineering and Materials ICMEM 2020 which was originally planned in June 2020 but will actually take place in 2021 in Nov Smokovec Slovakia because of the Covid 19 pandemic Despite the challenging times submitted contributions were peer reviewed and upon a careful revision included in this book which covers advances that are expected to increase the industry s competitiveness with regard to sustainable development and preservation of the environment and natural resources Condition monitoring industrial automation and diverse fabrication processes such as welding casting and molding as well as tribology and bioengineering are just a few of the topics discussed in the book s wealth of authoritative contributions A special emphasis is given to problems connected to climate change and solution manufacturer and engineers may adopt and

develop to prevent and cope with them *Comprehensive Materials Finishing* M.S.J. Hashmi,2016-08-29 Finish Manufacturing Processes are those final stage processing techniques which are deployed to bring a product to readiness for marketing and putting in service Over recent decades a number of finish manufacturing processes have been newly developed by researchers and technologists Many of these developments have been reported and illustrated in existing literature in a piecemeal manner or in relation only to specific applications For the first time *Comprehensive Materials Finishing Three Volume Set* integrates a wide body of this knowledge and understanding into a single comprehensive work Containing a mixture of review articles case studies and research findings resulting from R Finish Machining Processes by which a small layer of material is removed from the surface by various machining processes to render improved surface characteristics and Surface Coating Processes by which the surface properties are improved by adding fine layer s of materials with superior surface characteristics Each of these primary finishing processes is presented in its own volume for ease of use making *Comprehensive Materials Finishing* an essential reference source for researchers and professionals at all career stages in academia and industry Provides an interdisciplinary focus allowing readers to become familiar with the broad range of uses for materials finishing Brings together all known research in materials finishing in a single reference for the first time Includes case studies that illustrate theory and show how it is applied in practice **Recent Advancement in Manufacturing Processes** Rupinder Singh,2013-03-11 Special topic volume with invited peer reviewed papers only *Materials World* ,2003 *Technical Digest* ,1977 **Metals Abstracts** ,1994 *Dissertation Abstracts International* ,1992 **Thomas Register of American Manufacturers and Thomas Register Catalog File** ,1996 Vols for 1970 71 includes manufacturers catalogs **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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