Advanced Machining Process

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IIUM PRESS
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
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IIUM Press
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Perpustakaan Negara Malaysia  Cataloguing-in-Publication Data

Mohammad Yaakub Ali, AKM Nurul Amin & Erry Yulian Tribulas Adesta: Advanced Machining Process

ISBN: 978-967-418-162-8

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM (Malaysian Scholarly Publishing Council)

Printed By:
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com
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## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>ii</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>iii</td>
</tr>
<tr>
<td>Copyright</td>
<td>iv</td>
</tr>
</tbody>
</table>

**PART 1: ELECTRO DISCHARGE MACHINING** ................................1

**Chapter 1**
Tool Wear rate during Electrical Discharge Machining (EDM) with Eccentric Electrode
*Ahsan Ali Khan, Affendi Bin Saad and Mohd Zulfadli Isma Bin Mohd Isa*

Chapter 2
Wear Ratio and Work Surface Finish during Electrical Discharge Machining (EDM) with Eccentric Electrode
*Ahsan Ali Khan, Affendi Bin Saad and Mohd Zulfadli Isma Bin Mohd Isa*

Chapter 3
Role of Current, Voltage and Spark on-time on Electrode Material Migration during EDM
*Ahsan Ali Khan, Nurul Shima Mohd Noh*

Chapter 4
A Study on Material Removal Rate during EDM with Tantalum Carbide-Copper Compacted Electrode
*Ahsan Ali Khan, Mohammad Azhadi Bin Mohammad Hamibiyah and Mohd Faiz Bin Nazi Nadin*

Chapter 5
Features of EDM of Mild Steel with Ta-Cu Powder Compacted Electrodes
*Ahsan Ali Khan, Mohammad Azhadi Bin Mohammad Hamibiyah and Mohd Faiz Bin Nazi Nadin*

Chapter 6
Relationship between Machining Variables and Process Characteristics during Wire EDM
*Ahsan Ali Khan, M. B. M. Ali and N. B. M. Shaffiar*

v
Chapter 7
Influence of Machining Parameters on Surface Roughness during EDM of Mild Steel
Ahsan Ali Khan, Erry Y.T. Adesta and Mohammad Yeakub Ali

Chapter 8
Machining of Ceramic Materials: A Review
Abdus Sabur, Md. Abdul Maleque and Mohammad Yeakub Ali

Chapter 9
Formation of Micro-cracks and Recast Layer during EDM of Mild Steel using Copper Electrodes
Ahsan Ali Khan, Erry Y.T. Adesta and Mohammad Yeakub Ali

Chapter 10
Features of Electrode Wear during EDM of Mild Steel with TaC-Cu Powder Compacted Electrodes
Ahsan Ali Khan, Mohd Faiz Bin Nazi Nadin and Mohammad Azhadi Bin Mohammad Hambiyah

Chapter 11
Influence of Current, Spark On-time and Off-time on Electrode Wear during EDM of Mild Steel
Ahsan Ali Khan, Mohd Faiz Bin Nazi Nadin and Mohammad Azhadi Bin Mohammad Hambiyah

Chapter 12
A Comparative study on Work Surface Hardness EDMed by Ta-C Powder Compacted and Copper Electrodes
Ahsan Ali Khan, Mohd Faiz Bin Nazi Nadin and Mohammad Azhadi Bin Mohammad Hambiyah

Chapter 13
An Introduction to Electrical Discharge Machining
Ahsan Ali Khan and Mohammed Baba Ndaliman

Chapter 14
Developments in EDM Process Variables
Ahsan Ali Khan, Mohammed Baba Ndaliman and Mohammad Yeakub Ali
PART 2: MICROMACHINING ................................................................. 76

Chapter 15  ................................................................. 77
Focused Ion Beam Micromachining: Technology and Application
Israd Hakim Jaafar, Nur Atiqah, Asfana Banu, Mohammad Yeakub Ali

Chapter 16  ................................................................. 83
Finish Cut of Titanium Alloy using Micro Electro Discharge Milling
for Nano Surface Finish
Mohammad Yeakub Ali, Muhamad Faizal, Asfana Banu, and Nur Atikah

Chapter 17  ................................................................. 89
Investigation of MRR for Finish Cut of Titanium Alloy using Micro
Electro Discharge Milling
Mohammad Yeakub Ali, Mohd Saifuddin, Nur Atiqah, and Asfana Banu

Chapter 18  ................................................................. 95
Investigation of TWR for Finish Cut of Titanium Alloy using Micro
Electro Discharge Milling
Mohammad Yeakub Ali, Mohd Saifuddin, Nur Atiqah, and Asfana Banu

Chapter 19  ................................................................. 101
Investigation of Chip Formation and Minimum Chip Thickness in
Micro/Meso Milling: Methodology and Design of Experiment
Mohammad Yeakub Ali, Noor Adila Mansor and Siti Hamizah Mass Duki

Chapter 20  ................................................................. 107
Micro/Meso Milling of Aluminium Alloy 1100: Analysis and
Modelling of Minimum Chip Thickness
Mohammad Yeakub Ali, Noor Adila Mansor and Siti Hamizah Mass Duki

Chapter 21  ................................................................. 113
Effect of Micro End Milling Tool Diameter on Minimum Chip
Thickness
Mohammad Yeakub Ali, Noor Adila Mansor and Siti Hamizah Mass Duki

Chapter 22  ................................................................. 119
Micro Wire Electrical Discharge Machining of Tungsten Carbide:
Methodology and Procedure
Mohammad Yeakub Ali, Ahmad Chaaban Elahbath and Musah Jamal Alrefaie

Chapter 23  ................................................................. 124
Micro Wire Electrical Discharge Machining of Tungsten Carbide:
Analysis of Surface Roughness
Mohammad Yeakub Ali, Ahmad Chaaban Elahbath and Musah Jamal Alrefaie

Chapter 24  ................................................................. 130
Micro Wire Electrical Discharge Machining of Tungsten Carbide:
Analysis of Material Removal Rate
Mohammad Yeakub Ali, Musah Jamal Alrefaie and Ahmad Chaaban Elahbath

Chapter 25  ................................................................. 136
Micro Electro Discharge Machining of Micro Pillar Array: Process
Chapter 25
Micro Electro Discharge Machining of Micro Pillar Array: Process Development
Mohammad Yeakub Ali, Wan Emira Azaty and Nor Suriza

Chapter 26
Micro Electro Discharge Machining of Micro Pillar Array: Analysis of Surface Finish
Mohammad Yeakub Ali, Wan Emira Azaty and Nor Suriza

Chapter 27
Micro Electro Discharge Machining of Micropillar Array: Analysis of Material Removal Rate
Mohammad Yeakub Ali, Nor Suriza and Wan Emira Azaty

Chapter 28
Vibration Issue in Micro End Milling
Mohammad Yeakub Ali, Muhamad Lutfi and Mohamad Ismail Fahmi

Chapter 29
Fabrication of Micro Filter by Electro Discharge Machining
Abdus Sabur and Mohammad Yeakub Ali
PART 3: PRECISION MACHINING .............................................. 165

Chapter 30
High Speed Milling of Mould Steel using 1.5mm-diameter End-mills
Mohamed Konneh, Khairunnisa Ahmad and Rose Fazleen

Chapter 31
Precision Grinding of Silicon Carbide using 46 µm Grain Diamond Cup Wheel
Mohamed Konneh and Ahmad Fauzan

Chapter 32
Precision Grinding of Silicon Carbide using 76 µm Grain Diamond Cup Wheel
Mohamed Konneh and Mohd Shukur Zawawi

Chapter 33
Precision Grinding of Silicon Carbide using 107 µm Grain Diamond Cup Wheel
Mohamed Konneh and Mohd Fadzil

Chapter 34
Investigation of Surface Integrity during Precision Grinding of Silicon Carbide using Diamond Grinding Pins
Mohamed Konneh, Mohamad Lufti and Mohamad Shahrilnizam

Chapter 35
A Comparative Study on Flank Wear and Work Surface Finish during High Speed Milling of Cast Iron with Different Carbide Tools
Ahsan Ali Khan, Zuraida Aman Nor Rasid and Izaznawati Yusof
Chapter 2

Wear Ratio and Work Surface Finish during Electrical Discharge Machining (EDM) with Eccentric Electrode

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Keywords: EDM; Wear ratio; MRR; Electrode wear rate

Abstract. In the present work the performance of eccentric electrode during EDM has been studied. Material removal rate and tool wear rate increase with increase in spindle speed and feed rate. It was found that higher feed rate increases the wear ratio. Spindle speed values determined the flushing efficiency. A higher spindle speed improves the flushing efficiency and thus improves the surface roughness.

Introduction

In electrical discharge machining (EDM) materials is removed by heat energy created by electric sparks between an electrode and the workpiece in a dielectric medium. In this chapter, it was focused on electric discharge milling by using eccentric electrode which means that the electrode with fix diameter will be rotating with different centre offset with the spindle. This will cause the electrode to travel in bigger area from its own diameter. This movement also known as orbit or planetary motion and it will improve the flushing conditions and also has several important functions in EDM. Planetary technology can also be used to compensate for the errors produced during the process, which results in a better accuracy of the final part. For this type of EDM milling with eccentric electrode, the electrode will be setup as face milling on the EDM machine and equipped by spindle, so that while rotating as milling operation, it can cut the surface by using EDM mechanism. Because of EDM characteristic that the electrode will not touch the work material, there is no need of the electrode to have sharp cutting edge as in normal milling operation. The electrode just needs to be of cylindrical shape and rotate to remove the material. The tool used in this particular study is shown in Fig.1. Copper electrode has the higher material removal rate and lower electrode wear rate compared to graphite tool electrode [1]. Therefore, the tool material was taken as copper. The work materials were copper and mild steel.

Material Removal Rate and Feed Rate

During EDM process not only the workpiece is melted and vaporized, but the electrode also undergoes wear. It is desirable that more material is removed from the work while less amount of material is removed from the tool. Material removal rate at different feed rate is shown in Fig.2. El-Taweel et al [2] in his research claims that as the tool eccentricity increases, MRR decreases for all planetary motion modes (spiral and helix). It can be observed from Fig.2 that material removal rate increases with increase in spindle speed and feed rate. Tool wear rate at different feed rate is illustrated in Fig.3. It is evident from Fig.3 that tool wear rate increases with increase in spindle speed and feed rate. Newman et al. [3]