

CONFIRMATION

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the Bachelor Degree of Mechanical Engineering (Thermal-Fluids)

Signature



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12/12/2005

**THE EVALUATION OF MACHINABILITY AND SURFACE FINISH IN WIRE
CUT - ELECTRO DISCHARGE MACHINE**

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in partial fulfillment of the requirements for the award of Bachelor Degree of
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**Faculty of Mechanical Engineering
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October 2005

DECLARATION

“I hereby declare that the work in this thesis is my own research except for quotations and summaries as cited in reference”

Signature : 

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Date : 12/12/05

DEDICATION

To my beloved mother and father

ACKNOWLEDGEMENT

I want to wish grateful to my god because within the blessing, I can doing the thesis until finish

Here, I want to say thank you so long and speaking acknowledge to Mr. Mohd Ahadlin bin Mohd Daud such as a supervisor to this project because given me guideline and teaching during the periodic of finished the project

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ABSTRACT

Brass wire electrode with size 0.2 mm is used in Wire Cut Electro Discharge Machine (EDM) for different work piece in similar size at four various current values. Objective which achieved in this project are relationship between parameter of Wire Cut EDM (current) with different material as work piece. The material which used as workpiece in this experiment is copper, mild steel, brass and aluminium. This experiment are divide by two parts where in first part, machining test are progressed to three surfaces with different current value for each surface. In second part, machining test is progressed with change the material as work piece. From both experiment, surface finish will be produced are not depend only to current value which used during machining but then have relationship with type of material as work piece. After that, the research will be making for relationship between current value, material used and surface finish. This research encircles suitability around material usage with current usage and surface finish which will produce. As a result, we can known that the certain current only suitable for a certain material only but then not suitable for others material. Thus too with good surface finish, it is depend to current suitability which used during machining process.

ABSTRAK

Wayar elektrod Loyang dengan saiz 0.2 mm digunakan dalam EDM wayar potong untuk bahan kerja yang berlainan dalam saiz yang sama pada empat arus yang berbeza. Matlamat yang hendak dicapai dalam projek ini ialah perhubungan antara parameter EDM wayar potong (arus) dengan bahan yang berbeza sebagai benda kerja. Antara bahan yang terlibat sebagai benda kerja dalam ujikaji ini ialah kuprum, keluli lembut, loyang dan aluminium. Ujikaji ini dibahagikan kepada dua bahagian dimana dalam bahagian pertama ujian pemesinan dijalankan pada tiga permukaan dengan nilai arus yang berlainan untuk setiap permukaan. Pada bahagian kedua pula, ujian pemesinan dilakukan dengan menukar bahan lain sebagai benda kerja. Daripada kedua dua ujikaji, didapati bahawa kemas permukaan yang akan dihasilkan adalah tidak hanya bergantung kepada nilai arus yang digunakan semasa pemesinan tetapi juga mempunyai perhubungan dengan jenis bahan yang dipilih sebagai benda kerja. Selepas itu, kajian akan dibuat terhadap perhubungan antara nilai arus, bahan yang digunakan dan kemas permukaan. Kajian ini merangkumi kesesuaian antara penggunaan bahan dengan penggunaan nilai arus dan kemas permukaan yang terhasil. Sebagai keputusannya, kita boleh mengetahui bahawa sesetengah arus hanya sesuai untuk sesetengah bahan dan tidak sesuai untuk bahan yang lain. Begitu juga dengan kemas permukaan, ia bergantung kepada kesesuaian arus yang digunakan semasa proses pemesinan.

CONTENTS

CHAPTER	ITEMS	PAGES
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	LIST OF CONTENT	vii
	LIST OF TABLE	xi
	LIST OF FIGURE	xii
	LIST OF SYMBOL	xiv
	LIST OF APPENDIX	xi
1	INTRODUCTION	
	1.1 Introduction	1
	1.2 Objectives	2
	1.3 Scope	3
	1.4 Problem Statement	3
	1.5 Problem Analysis	3
2	LITERATURE REVIEW	
	2.1 Introduction	4
	2.1.1 Electro Mechanical Theory	4
	2.1.2 Thermo Mechanical Theory	5

2.1.3	Thermo Electric Theory	5
2.2	Working Principle of EDM	5
2.2.1	Mechanical Structure	8
2.2.2	Spark Generator	8
2.2.3	Servo System	9
2.2.4	Dielectric Circuit	9
2.3	Type of EDM	10
2.3.1	Die-Sinking EDM	10
2.3.2	Wire Cut EDM	11
2.3.3	EDM milling	14
2.3.4	Wire Electric Discharge Grinding	14
2.4	Basic Process Factor of EDM	14
2.6.1	Electrode Material	14
2.6.2	Dielectric Fluid	15
2.5	Material of Work piece	16
2.5.1	Copper	16
2.5.2	Mild Steel	17
2.5.3	Brass	17
2.5.4	Aluminium	18
2.6	<i>ON</i> time, <i>OFF</i> time and <i>I_p</i>	18
2.7	Power Source	19
2.8	Measurement Machining of Efficiency	20
2.8.1	Material Removal Rate (MRR)	20
2.8.2	Surface Finish Texture	21
2.9	Wear Electrode	23
2.10	Material Removal Mechanism	24
2.10.1	Breakdown (Ignition) Phase	25
2.10.2	Discharge Phase	26
2.10.3	Erosion (Crater Formation) Phase	27
2.11	Characteristic of EDM Surfaces	27
2.12	Thermally Influenced Layers	28

	2.13 Stress Distribution	28
3	METHODOLOGY RESEARCH	
	3.1 Introduction	29
	3.2 EDM Test Equipment	29
	3.2.1 Wire Cut EDM (Model Mitsubishi RA 90)	29
	3.3 Test Preparation	31
	3.4 Test Procedure	31
	3.5 Measuring Technique	32
	3.6 Result	32
	3.7 Flow Chart of Project Progress	33
	3.7.1 Description	34
	3.8 Expected Graph	35
4	APPARATUS	
	4.1 Apparatus	38
	4.2 Workpiece	38
	4.3 Other machine that used	39
	4.4 Experimental method	41
5	RESULT AND DISCUSSION	
	5.1 Result	43
	5.1.1 Copper as workpiece	43
	5.1.2 Mild Steel as workpiece	44
	5.1.3 Aluminium as workpiece	44
	5.1.4 Brass as workpiece	45
	5.2 Graph	45
	5.3 Discussion	50
	5.3.1 Copper	50
	5.3.2 Mild Steel	50
	5.3.3 Aluminium	51

5.3.4	Brass	52
5.4	Surface roughness maximum (Rmax)	52
5.4.1	Copper	53
5.4.2	Mild Steel	53
5.4.3	Aluminium	53
5.4.4	Brass	54
5.5	Suitable Current	54
6	CONCLUSION AND RECOMMENDATION	
6.1	Conclusion	56
6.2	Recommendation	57
	REFERENCES	58
	APPENDIX	61

LIST OF TABLE

TABLE NO.	ITEMS	PAGES
2.1	Advantage and disadvantage type of power source	20
2.2	Calculation for any types of wear	24
5.1	Value of surface roughness for copper	43
5.2	Value of surface roughness for mild Steel	44
5.3	Value of surface roughness for aluminium	44
5.4	Value of surface roughness for brass	45

LIST OF FIGURE

FIGURE NO	ITEMS	PAGES
2.1	Basic Elements of an EDM system	7
2.2	Die sinking process	11
2.3	Wire Cut EDM	12
2.4	Work piece by forcing a spark	12
2.5	Detail cutting process by Wire-cut EDM	13
2.6	Definition of kerf and overcut in Wire-cut EDM	13
2.7	Surface Roughness Measurement Data	22
2.8	Electrolytic Corrosion on Workpiece Surface	23
3.1	Machine which used (RA 90)	31
3.2	Pause time versus discharge frequency	35
3.3	Result of controlling pause time	35
3.4	Expected result of surface roughness for copper	36
3.5	Expected result of surface roughness for Mild Steel	36
3.6	Expected result of surface roughness for Brass	37
3.7	Expected result of surface roughness for Aluminium	37
4.1	Cutting part	39
4.2	Workpiece after cutting process	39
4.3	Surface Roughness Tester (Mitutoyo SJ 301)	40
4.4	Cut-off Machine	40
4.5	Workpiece was tighten at handle	41
4.6	Specimen was testing by surface roughness tester	42
4.7	Data and wave produced is printed	42
5.1	Surface roughness (R_a) by different current	

for copper		46
Surface roughness (R_{max}) by different current for copper	Surface roughness (R_{max}) by different current	46
Surface roughness (R_a) by different current for mild steel	Surface roughness (R_a) by different current	47
Surface roughness (R_{max}) by different current for mild steel	Surface roughness (R_{max}) by different current	47
Surface roughness (R_a) by different current for aluminium	Surface roughness (R_a) by different current	48
Surface roughness (R_{max}) by different current for aluminium	Surface roughness (R_{max}) by different current	48
Surface roughness (R_a) by different current for brass	Surface roughness (R_a) by different current	49
Surface roughness (R_{max}) by different current for brass	Surface roughness (R_{max}) by different current	49
Suitable current for a good surface	Suitable current for a good surface	54
Suitable current for a maximum roughness	Suitable current for a maximum roughness	55

	for copper	46
5.2	Surface roughness (R_{\max}) by different current for copper	46
5.3	Surface roughness (R_a) by different current for mild steel	47
5.4	Surface roughness (R_{\max}) by different current for mild steel	47
5.5	Surface roughness (R_a) by different current for aluminium	48
5.6	Surface roughness (R_{\max}) by different current for aluminium	48
5.7	Surface roughness (R_a) by different current for brass	49
5.8	Surface roughness (R_{\max}) by different current for brass	49
5.9	Suitable current for a good surface	54
5.10	Suitable current for a maximum roughness	55

LIST OF SYMBOL

SYMBOL

DEFINATION

R_a	Roughness value
R_{max}	Maximum roughness value
x	x axis
y	y axis
I_p	Current peak
MRR	Material Removal Rate
<	Less than

GREEK

μ	Micron
-------	--------

SHORT FORM

EDM	Electrical Discharge Machining
2-D	Two Dimensions
3-D	Three Dimensions
CNC	Computer Numerical Control
sec	Second

UNITS

A	Ampere
mm	millimeter
°C	Degree Celcius
V	Volt
mm ² /s	millimeter square per second
°	Degree
MPa	Megapascal
%	Percent
mm ³ /min	millimeter cube per minute
in ² /h	inch square per hour
in	inch
m	meter

LIST OF APPENDIX

APPENDIX	TITLE
A	Wave of roughness for copper at surface 1
B	Wave of roughness for copper at surface 2
C	Wave of roughness for copper at surface 3
D	Wave of roughness for mild steel at surface 1
E	Wave of roughness for mild steel at surface 2
F	Wave of roughness for mild steel at surface 3
G	Wave of roughness for aluminium at surface 1
H	Wave of roughness for aluminium at surface 1
I	Wave of roughness for aluminium at surface 1
J	Wave of roughness for brass at surface 1
K	Wave of roughness for brass at surface 2
L	Wave of roughness for brass at surface 3
M	Future of wire cut model RA 90
N	Future and option
O	Specification
P	Control unit
Q	External dimension
R	Specimen of coper
S	Specimen of mild steel
T	Specimen of aluminium
U	Specimen of brass
V	Gantt chart

CHAPTER 1

INTRODUCTION

1.1 Introduction

Machining is an important process in manufacturing engineering. It is divided by two methods to say conventional machining and unconventional machining.

For example of the conventional machining are milling, drilling, and lathe. According to this method, the quality of production depends on the efficiency of the operator, the type of process chosen, and the type of material used. Also, in certain cases where conventional machining is not suitable to be applied. Such as an example where the shape we want to produce is complicated. It is because producing complicated parts needs high cost and a long production time.

Furthermore, in modern technology, we get various new materials from other sources. It is shown indeed we need a new method for improvement and upgrading the quality of metal machining. So that, to solve this problem we need unconventional machining to overcome the weakness of conventional machining. The production of unconventional machining is better if the parameters chosen are better. It is because this method is limited to certain parameters only.

Wire-cut EDM is applied in this project as a part of unconventional machining. Wire-cut EDM is a process for machining electrically conductive materials

by sparks in the presence of a dielectric using a traveling wire as the cutting tool. Wire - cut EDM has been described as an electronic band saw. This description is quite good since the shape machined is basically two dimensional and is always machined completely through the workpiece. All kind of process achieved to happen with easily by Wire-cut EDM. Now, the Wire-cut EDM already accepted with way widespread in industrial section. This machines many of these using machine workshops especially in mould and equipment production.

1.2 Objective

Machining by Wire-cut EDM is depending to types of parameter. Even though, this project progressed will be concentrate to surface finish at different work piece whenever the transition current happening during the machining process. The material of work piece are used in this project is mild steel, copper, brass and aluminium. Where as the size of material will be using in this machining is 100 mm x 50 mm x 10 mm.

So that, determination of relationship between different current and different surface going to be main objective in this project. Surface effect is happen will be check by observation machine based on current used. As extra activity, the relationship between different current and different surface at various material obey to observe. After that, I would like to study about a suitable current for certain material to be produce good surface finish. It is purpose to reduce the wear of electrode and economize cost. In this case also, I want to study about a suitable electrode for certain material which want to cut. Finally, I hope this objective achieve the target which wanted.

1.3 Scope

The scope of this study limits the early choice of copper wire electrode and steel material as a work piece. Example of steel material is used as work piece is copper, mild steel, brass and aluminium. Aspects of the result that are under observation are machinability and surface finish. First experiment, the cutting process is happened to copper with three surface and different values of cutting current. After that, in similar process, used another steel material and different values of cutting current.

1.4 Problem Statement

In machining process, it is very important to get optimum cutting result where it can reduce cutting time, reduce the wear of electrode, save the operation cost, save the material cost and finishing with a good surface texture. But then, the problem will be occur is finishing surface texture are not good and unsatisfactory. In normally case, also get the electrode which breaks off during machining process. So, this research will be shown to me how and why it happens.

1.5 Problem Analysis

To solve this problem, I will be using a different value of cutting current. After this, I can do the observation to cutting surface produced. To do the observation, surface roughness tester will be used to see the surface which produced. Assessment is maker based on surface produced after machining process complete. Comparison between different value of current and different surface also will be make. I also will be check the material of electrode which suitable for cutting the something material.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Material removal is happening during the work piece machinery with wire-cut EDM based on the effect of erosion sparks. Multifarious of theory already shown to explanation the phenomenon of sparks. Also found a three theory to demonstrated are :

- a) Electro Mechanical Theory
- b) Thermo Mechanical Theory
- c) Thermo Electric Theory

2.1.1 Electro Mechanical Theory

This theory are designate that the material atomic going to be crude caused a concentrated of electric field. The electric field isolated the atomic at work piece after that exceeding to resistant force in material cleft. The theory decline any effect of heated and the EDM process are not given any effect to material characteristic at surface of work piece. Although that, the experimental running are shown weakness proven to support this theory.

2.1.2 Thermo Mechanical Theory

This theory is designate that the material throw away during electric discharge of machinery caused by molten material are produced by reason of sparks. The sparks outcome from various electric effects is produced during discharge. Even though, this theory are not support from experimental data and failure to given explanation a reasonable about erosion of sparks.

2.1.3 Thermo Electric Theory

Verification according the experimental is successful to support this theory. The theory suggestion indeed the throw away metals during electric discharge machinery caused by resultant of over temperature from generated discharge current. Even though, the theory not accepted with sure and completed because the interpretation are complicated. In this time, the theory are better depend the other theory.

2.2 Working Principle of EDM

The electric discharge process is thermo electric process wear away material from work piece through sparks production which continuous between workpiece and cutting tool. During the operation, electrode and work piece to be submerged in dielectric fluid.[Yankee H.W., 1979]. Level of fluid must be not less of 50 mm on surface of work piece and this depth must be permanent for shunt to be happen a burn case. The material reducing by electric discharge will be terminated by dielectric fluid.

The energy source for each discharge is from capacitance which discharging with alternating current or direct current. Normally, a continuation to power sourced is

allotted for given the negative polarities to electrode and positive polarities to work piece. [Yankee H.W., 1979].

The electrode with negative charge is carried nearer metal work piece with positive charge. Electrode distance from surface of work piece is 0.025 mm until 0.050 mm and will be controlled by servo motor [Boothroyd G. et.al., 1979]. The gap between two parts is fully with dielectric fluid. Become more nearer of two conductors, become more high potential differential that the produce between electrode and work piece. Till the potential differential become more high level, the electron produced will be ionizing dielectric fluid causing increasing the electron flowing. Next, the situation causing sparks is generating.

The sparks produced to be directed to work piece with very high speed. Later, smelt are happen and vaporize the small partial of work piece. That will be causing put aside of concave effect at work piece surface. The metal vaporized will be floating in dielectric fluid such as metal cloud. Later than, condensation process to small atomics must be spurt out with faster. The temperature at this situation is assuming between 8300°C until 16600°C [Yankee H.W., 1979].

The electron will be flow from electrode with continuous through ionize line in dielectric toward the work piece. The electron flowing is continuous until the potential between of two electrode and work piece are not maintained where the voltage is down to 20 V and the process will be stopped. At this level, dielectric fluid will be reionizing. The voltage also increased and this process are reoccur [Yankee H.W., 1979]. The pulsation reoccur can achieve 100 000 time per second [Boothroyd G. et.al., 1979].