



**STUDY ON SURFACE INTEGRITY OF TUNGSTEN CARBIDE MACHINED
BY DIE-SINKING EDM USING TAGUCHI METHOD**

AMIZAN B. AMRAN

(2006863933)

A thesis submitted in partial fulfillment of the requirement for the award of
Bachelor Engineering (Hons) Mechanical

**FACULTY OF MECHANICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA (UiTM)
MALAYSIA**

MAY 2009

ACKNOWLEDGEMENT

I would like to express my sincere gratitude and appreciation to my project advisor Pn Norliana binti Mohd Abbas for her support, generous guidance, patience and encouragement in duration of this thesis preparation until its completion. I would like to thank En Wan Emri bin Wan Abdul Rahman for his kindness in giving me good information that is very useful in completing this thesis. I want to thank to all technicians of Metrology Laboratory and Material Science Laboratory for their kind involvement in this study.

Not forget to family that always support and encourage me during my study. For my entire friend especially Mohammad Rahimatul Azwa, Mohammad Razmi and Norlizan that always help me during this study. Finally, I would like to express my greatest appreciation to everyone who involved directly or indirectly in helping me to complete this final year project.

ABSTRACT

Tungsten Carbide is one of the important composite materials that are used in the manufacture of cutting tools, dies and other special tools. It has high hardness and excellent resistance to shock and wear, and is not possible to machine easily using conventional techniques. Tungsten Carbide is subjected to electro discharge machining (EDM) which is one of the famous non-traditional cutting techniques in industry. In Malaysia industries, EDM is widely used for machining plastic injection moulds, stamping dies and parts of automotive, defense, electronics and telecommunication industries. Taguchi method with the selected parameter was implemented in this study to identify the influence of selected parameter towards the surface integrity. Surface integrity is an analysis on microstructure, topography, depth of cut, roundness and hardness. The results are discussing on the influence of selected combination of factors toward the material. All the machined specimens were studied in Material Science and Metrology Laboratories, Faculty of Mechanical Engineering in Universiti Teknologi MARA (UiTM) Shah Alam. It was found that the parameters produced different kind of surface results. It is depend on priority of product criteria that want to be produced. The priority on each surface integrity aspects such as roundness, topography, depth of cut and hardness has its own parameter setup.

TABLE OF CONTENTS

CONTENTS	PAGE
PAGE TITLE	i
ACKNOWLEDGEMENT	ii
ABSTRACT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	ix
LIST OF FIGURES	x

CHAPTER 1 INTRODUCTION

1.0	The Title of Research	1
1.1	Background of Research	1
1.2	Objective of Research	2
1.3	Problem Statement	3
1.4	Scope of Study	3
1.5	Significant of Research	4

CHAPTER II

LITERATURE REVIEW

2.0	Introduction to Literature Review	5
2.1	Electrical Discharge Machining (EDM)	6
2.1.1	Die Sinking EDM	7
2.1.2	Principles of EDM	8
2.1.3	Advantages and Disadvantages	9
2.2	EDM Parameters	10
2.2.1	Dielectric Fluids	10
2.2.2	Electrodes	10
2.2.2.1	Copper Tungsten	11
2.2.2.2	Copper	12
2.2.3	Current	12
2.2.4	Capacitance	13
2.2.5	Polarity	13
2.3	Workpiece Material	14
2.3.1	Tungsten Carbide	14
2.4	Surface Integrity	15
2.4.1	Microstructure (White Layer)	16
2.4.2	Hardness Test	17
2.4.2.1	Rockwell hardness	17
2.4.2.2	Brinell Hardness	18
2.4.2.3	Vickers Hardness	19
2.4.3	Roundness	19
2.4.3.1	Conventional Roundness Measurement	20
2.4.3.2	Non-contact Measurement	20
2.4.4	Depth of Cut	21
2.4.5	Topography	21
2.5	Taguchi Method	22
2.5.1	Introduction to Taguchi Method	22
2.5.2	Taguchi Methodology	23