



FATIGUE OF CARBURIZED SAMPLES

RASHDAN BIN BAHAROM

(99300274)

MUHAMMAD IQBAL BIN ALHADI

(99384654)

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

**Faculty of Mechanical Engineering
Universiti Teknologi MARA (UiTM)**

MARCH 2002

ACKNOWLEDGEMENT.

Alhamdulillah, with the blessing and help from Allah S.W.T we manage to carried out this experiment successfully.

We are also very grateful to Prof. Madya It Dr. Mohamad Nor bin Berhan who initiated and supervised our final project. With his guidance, enable us to do our experiment smoothly. The freedom that he gives us on result we obtain while doing experimental work, gave us much more confidence and independently.

We would like to convey our special thank to En. Abu Kassim Salleh, Strength of material lab assistant, En. Hayub Ta, Material science lab assistant and En. Halim, Technical assistant of Mechanical Engineering workshops. With their permission and guidance on how to use equipment available on their lab or workshops, make our job simple and easier.

Finally, with our family support especially on financial, ease our burden very much since some of the material we need are not available in the workshops or lab therefore we have to acquired it from outside source which is very costly indeed. We also have to sacrifice our semester break which usually we spare it with our family and go down to workshop and lab in order to finish the experimental work on time.

All the kindness and understandable of each individual who directly or indirectly involves in our final year projects are remembered all the times. Thank you very much.

ABSTRACT

Metal failure is a common phenomenon. Most of metal failure is due to fatigue problem. Researchers have been trying to find solutions on how to overcome this fatigue problem. The impact of this fatigue problem can be catastrophic, especially in aviation industries. However this fatigue problem cannot be stopped, we may only delay the problem or predict when it will go on by empirical method, which is known as S-N curves. From these curves safety limit is set and maintenance schedule is set.

This project was carried out to study on comparison of non-carburized samples and carburized samples of steel. The carburized samples were divided into two groups that is 3 hours and 6 hours. From the data obtained through fatigue testing, a graph of bending stress vs. no of cycles was plotted.

Microstructures studies were also conducted to determine the phases and thickness of carburized layer from different samples. Crack initiation sites were determined through Scanning Electron Microscope (SEM).

TABLE OF CONTENT

CONTENTS	PAGE
ACKNOWLEDGEMENT	i
ABSTRACT	ii
CHAPTER 1 INTRODUCTION	
1.0 Background Of Project	1
1.1 Scope of Project	2
1.2 Objectives of Project	3
1.3 Methodology	3
CHAPTER 2 THEORY	
2.0 Mild Steel	4
2.1 Reference Properties	5
2.2 The Role Of Carbon	8
2.3 Martensite In Steel	9
2.4 Carburization	10
2.4.1 Type Of Carburization	12
2.4.2 Method Of Carburization	13
2.4.3 Carburization Layer Thickness	14
2.4.4 Calculation For Carbon Content	14
2.5 Fracture Modes	17

2.6	Fatigue Failure	18
2.7	Crack Initiation And Propagation	20
2.8	Fatigue Failure Analysis	23
2.9	Factors That Affects Fatigue Failure	23
2.10	Environment Effects	27
2.11	Fatigue Loading	28
2.12.	Laboratory Fatigue Testing	29
4.1\$	Rockwell Hardness Test	30
CHAPTER 3 MATERIAL PREPARATION AND EQUIPMENTS.		
3.0	Specimen Preparation	32
3.1	Specimen Modification	33
3.2	Polishing Process	33
33	Carburization Process	34
CHAPTER 4 EXPERIMENTAL METHODS.		
4^5	Hardness Test.	35
%ti	Microstructure Study.	35
4.2	Fatigue Test	37
CHAPTER 5 RESULTS		
5.0	Carburization Layer Study	38
5.1	Scanning Electron Microscope (SEM)	41
5.2	Hardness Test	43
53	Fatigue Test	44
CHAPTER 6 DISCUSSIONS.		
CHAPTER 7 CONCLUSIONS AND RECOMMENDATION		
APPENDIXES		
REFERENCES		