



UNIVERSITI PUTRA MALAYSIA

**CONSTRUCTION OF FLASH METHOD FOR DETERMINING
THERMAL DIFFUSIVITY OF SOLIDS**

TEH CHZE LING

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**CONSTRUCTION OF FLASH METHOD FOR DETERMINING
THERMAL DIFFUSIVITY OF SOLIDS**

By

TEH CHZE LING

**Thesis Submitted in Fulfilment of the Requirement for the Degree of
Master of Science in the Faculty of Science and Enviromental Studies
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TABLE OF CONTENTS

	Page
ABSTRACT	ii
ABSTRAK	iv
ACKNOWLEDGEMENTS	vi
APPROVAL	vii
DECLARATION	ix
LIST OF FIGURES	xiii
LIST OF TABLES	xvi
LIST OF PLATES	xvii
 CHAPTER	
I	
INTRODUCTION	
Background of Thermal Diffusivity.....	1
Objective of Study.....	3
Importance of Study.....	4
Scope of Study.....	5
 II	
LITERATURE REVIEW	
Flash Technique.....	6
Standard Malaysian Rubber.....	9
Epoxidized Natural Rubber (ENR).....	12
Preparation.....	12
Physical Properties of ENR.....	13
Application of ENR.....	15
Vulcanization.....	15
Carbon Black.....	17
Surface Area.....	18
Particle Size.....	18
Structure.....	19
Surface Chemistry.....	19
High Tc Ceramic Superconductor.....	21
 III	
THEORY	
Theory of Flash Technique.....	23
Estimation of Errors and Correction.....	28
Finite Pulse Time Effect.....	29
Radiation Heat Loss Effect.....	31
Thermal Diffusivity Determination Using The Iterative Procedures.....	32
Thermal Conductivity of Solids.....	34



	Heat Transport Property of Polymer.....	36
	Thermal Transport Properties for Crystalline and Amorphous Polymers.....	36
	Heat Transport for Amorphous Polymers at $T > 150\text{K}$	40
	Heat Transport in High T_c Superconductor.....	41
	Thermal Conductivity in Normal State.....	41
	Thermal Conductivity in Superconducting State...	43
IV	METHODOLOGY	
	Overview of the Method.....	46
	Flash Method Detection System.....	46
	Photo flash.....	46
	Sample.....	48
	Sample holder.....	49
	Thermocouple.....	50
	Other apparatus.....	50
	Data Acquisition Card (PCI-6024E).....	51
	Graphical Programming with Labview.....	51
	AI Config.vi.....	56
	AI Start.vi.....	57
	AI Read.vi.....	58
	Save.vi.....	59
	Experimental Procedure.....	60
	X-Ray Diffraction Analysis.....	64
V	RESULTS AND DISCUSSION	
	Calibration.....	67
	Sample Thickness.....	72
	Thermal Diffusivity of SMR-5, ENR-25 and ENR-50.....	75
	Scanning Electron Microscopy.....	80
	The Effect of Carbon Black on Thermal Diffusivity.....	80
	The Effect of Epoxidation on Thermal Diffusivity.....	87
	Thermal Diffusivity of Ceramic Superconductor.....	94
	Data Analysis Using Iterative Procedure.....	94
	The Effect of Substitution of Samarium on Thermal Diffusivity.....	100
VI	CONCLUSION AND RECOMMENDATIONS	
	Summary.....	104
	Recommendation.....	106



BIBLIOGRAPHY	108
APPENDIX A-1	112
APPENDIX B-1	113
APPENDIX B-2	115
APPENDIX C-1	116
VITA	117



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Chairman: Zaidan Abdul Wahab, Ph.D.

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In this study, flash method was employed in determining thermal diffusivity of solids at room temperature. This method is applicable to any flash apparatus (in this study we used Minolta Photoflash) using a setup similar to the one presented by Parker et al.. The first part of the study is undertaken to calibrate the setup with a sample of known thermal diffusivity. The results clearly indicate that the thermal diffusivity of the calibration sample correlated well with the results from literature. Apart from that, a data acquisition system that simulate the front panel of an oscilloscope is developed using LabView RT 5.1, a graphical programming language for acquiring experimental data.

For practical purposes, we assume that the boundary conditions of the method are obeyed. Two data reduction methods, the conventional method and the iterative procedure were employed in determining the thermal diffusivity. The conventional method (correction of finite pulse time effect, non-uniform heating and heat loss)



was the commonly used method to determine the thermal diffusivity. However, the latter was found to allow one to determine thermal diffusivity with good accuracy without the need to normalize the non-dimensional curve and determine the $t_{1/2}$ manually.

The second part of the study involves the testing of the setup with rubber and superconductor sample. The effect of carbon black was investigated in SMR-5, ENR-25 and ENR-50. It is found that the thermal diffusivity increase with the increased in carbon black content for all three rubber samples. Study on the effect of epoxidation was also carried out. Since, the variation of thermal diffusivity cannot be concluded, an attempt to determine the crystallinity from the X-ray diffraction was carried out to assist in explaining the changes. The experimental results indicate that as the level of epoxidation increases the thermal diffusivity decreases for rubber without carbon black and the thermal diffusivity increases for rubber with carbon black as suggested by its crystallinity. In addition, the role of samarium doping in causing differences in the nature of thermal diffusivity for Bi-based superconductor was also reported. It is found that thermal diffusivity decrease with the increase in samarium.

It is recommended that future research and development be carried out to fully automate the whole sequence of thermal diffusivity measurements for both room and high temperature.

