

CONTENTS

	PAGE
ENGLISH ABSTRACT	i
THAI ABSTRACT	ii
ACKNOWLEDGMENTS	v
CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST ABBREVIATIONS	xii
CHAPTER	
1. INTRODUCTION	1
1.1 Motivation	1
1.2 Research Objectives	2
1.3 Research Boundaries	2
1.4 Advantages and Applications	2
2. REVIEW AND THEORY	4
2.1 Introduction of magnetic recording head and fabrication process	4
2.2 Introduction of diamond-like carbon	6
2.3 Structure of diamond-like carbon	6
2.4 Deposition process	8
2.5 Filtered cathodic arc deposition overview	10
2.5.1 Filtered cathodic arc deposition	10
2.5.2 Particle filter system and plasma transport efficiency	11
2.6 Characterization of DLC films	13
2.6.1 Raman spectroscopy for microstructure characterization	13
2.6.2 X-ray photoelectron spectroscopy for material composition characterization	16
2.6.3 Ellipsometry for optical property characterization	20
2.6.4 Nanoindentation for wear resistance characterization	21
2.6.5 Corrosion resistance test on magnetic recording head	23
2.6.6 Atomic force microscopy for surface topography characterization	24
2.7 Effect of thermal heating to microstructure and material composition	25
2.8 Effect of thermal heating to wear resistance of DLC	31
2.8.1 Wear behavior	31
2.8.2 Effect of thermal heating on film wear resistance	31
2.9 Effect of thermal heating of surface roughness of DLC	33
3. EXPERIMENTATION AND METHODOLOGY	35
3.1 ta-C films deposition	35
3.1.1 Surface cleaning by Ar ion beam etching	35
3.1.2 Si-Si ₃ N ₄ sputtering	35
3.1.3 ta-DLC deposition	35
3.1.4 Deposition tool	36
3.2 Thermal heating condition	37

CONTENTS

	PAGE
3.3 ta-C films characterization	38
3.3.1 Film structure characterization by Raman spectroscopy	38
3.3.2 Chemical bonding characterization by X-ray photoelectron spectroscopy (XPS)	39
3.3.3 Wear resistance characterization by Nanoidenter	39
3.3.4 Corrosion resistance characterization by acid dip test	40
3.3.5 Optical property characterization by ellipsometer	40
3.3.6 Films density characterization by X-ray reflectivity (XRR)	41
3.3.7 Surface roughness characterization by Atomic Force Microscopic (AFM)	42
4. RESULTS AND DISCUSSIONS	43
4.1 Effect of thermal heating on film structure	43
4.2 Effect of thermal heating on chemical bonding	46
4.3 Effect of thermal heating on wear resistance	51
4.4 Effect of thermal heating on corrosion resistance	52
4.5 Effect of thermal heating on film optical property	54
4.6 Effect of thermal heating on film density	54
4.7 Effect of thermal heating on surface roughness	55
5. CONCLUSION	58
REFERENCES	59
CURRICULUM VITAE	63