

Contents

	page
Abstract	I
Abstrak	II
Acknowledgement	III
Chapter 1: Introduction	1
1.1 Graphite, diamond and diamondlike carbon	1
1.2 Plasma synthesis of diamond or diamondlike carbon films	4
1.3 Some application of CVD diamond and diamondlike carbon films	12
1.3.1 Electronic packaging	12
1.3.2 Cutting tools	12
1.3.3 Surface acoustic wave devices	13
1.3.4 Radiation detectors	14
1.3.5 Effective negative electron affinity	14
1.3.6 Protective coating	15
1.3.7 Anti-stick coating	15
1.4 Inductively coupled plasma (ICP) system	15
1.5 Planar coil configuration	17
1.6 Diamondlike carbon (DLC) thin film coating with RF ICPs	19
1.7 Objective and the organization of this thesis	19
Chapter 2: System Descriptions and Instrumentations	20

2.1	Inductively coupled plasma system (ICPs)	20
2.2	Reactor chamber	23
2.3	Vacuum system and pressure measurement system	24
2.4	RF power and matching network	25
2.5	The gas inlet system	29
2.6	Diagnostic system	31
	2.6.1 Voltage measurement	31
	2.6.2 Current measurement	35
	2.6.3 CCD based spectroscopic system	36
2.7	Surface analysis instruments	36
	2.7.1 SEM and EDAX	36
	2.7.2 Micro-Raman system	39
Chapter 3: Discharge Characteristics of ICP System		43
3.1	Overview	43
3.2	Experimental observation of E to H mode transition	45
3.3	Effect of operating pressure on E to H mode transition	60
3.4	Discharge of hydrogen and methane admixture	63
3.5	The study of induction heating effect of silicon substrate in hydrogen and methane discharge	67

Chapter 4: Plasma Enhanced Chemical Vapour Deposition of Diamondlike Carbon Thin Film	72
4.1 Plasma enhanced chemical vapour deposition	72
4.2 CVD diamond / diamondlike carbon films	74
4.3 Nucleation and growth of diamond / diamondlike carbon films	75
4.4 Substrates for CVD diamond / diamondlike carbon films formation	77
4.5 Sample pretreatment	80
4.6 PECVD of diamondlike carbon films on silicon substrate	81
4.6.1 Substrate pretreatment and cleaning	81
4.6.2 Deposition method and procedure	82
4.7 Effect of percentage of methane on DLC thin film coating	83
4.7.1 Results	85
4.7.1.1 Sample Si1 prepared with 0.8% methane Gas	85
4.7.1.2 Sample Si2 prepared with 1.0% methane Gas	85
4.7.1.3 Sample Si3 prepared with 3.0% methane Gas	86
4.7.1.4 Sample Si4 prepared with 5.0% methane Gas	86
4.8 Effect of substrate pretreatment	87
4.9 Effect of the induction heating on PECVD diamondlike carbon coating	87
4.10 Discussions	95

Chapter 5: Conclusions and Suggestions for Future Work	96
5.1 Conclusions	96
5.2 Suggestions for future work	98
References	99