

CONTENTS

Chapter 1	INTRODUCTION	1
	References	3
Chapter 2	LITERATURE REVIEW	
2.1	Amorphous Silicon	4
2.2	Preparation Technique	5
2.2.1	Thermal Evaporation	6
2.2.2	Sputtering	7
2.2.3	Chemical Vapour Deposition	9
2.2.4	Plasma Glow Discharge Decomposition	11
2.2.5	D.C Plasma Glow Discharge Decomposition with Argon Dilution	13
2.3	Structure of Amorphous Silicon	14
2.4	Optical Properties	17
2.4.1	Absorption Edge	17
2.4.2	Optical Properties of Thin Semiconducting Films	19
2.4.3	Refractive Index (n)	24
2.4.4	Optical Energy Gap (E_g)	25
2.4.5	Urbach Tail Bandwidth (E_c)	27
2.5	Effects of Argon (Ar) Dilution	27
2.6	Morphology Studies of Atomic Force Microscopy (AFM)	30
2.7	Hydrogenated Amorphous Silicon	33
	References	35
Chapter 3	EXPERIMENTAL METHODS	
3.1	Introduction	38
3.2	Substrates Cleaning Procedures	39
3.3	Instrumentation of D.C Plasma Glow Discharge System	40
3.3.1	Reaction Chamber	40
3.3.2	The Pumping System	43
3.3.3	The Electrical System	44
3.3.4	Gas Distribution System	44
3.3.5	Detoxification System	45

Chapter 3	3.4 Preparation Technique	47
3.4.1 Pre-deposition Procedure	48	
3.4.2 a-Si:H Deposition with Pure Silane Discharge	49	
3.4.3 a-Si:H Deposition with Discharge of Silane Diluted in Argon	49	
3.4.4 Post-deposition Procedure	50	
3.4.5 Deposition Parameters	50	
3.5. Optical Characterization	52	
3.5.1 Optical Transmission	52	
3.6 Atomic Force Microscopy (AFM)	55	
3.6.1 Feedback System	56	
3.6.2 Tip sample Interaction	57	
3.6.3 Atomic Force Microscope Principle	58	
References	59	

Chapter 4 OPTICAL TRANSMISSION SPECTRUM : ANALYTICAL TECHNIQUE, RESULTS AND ANALYSIS

4.1 Introduction	61
4.2 Optical Transmission Spectra of a-Si:H Films	62
4.3 Analytical Technique	67
4.3.1 Determination of Thickness and Refractive Index	67
4.3.2 Determination of Thickness and Refractive index by Iteration Technique	69
4.3.3 Determination of Absorption Coefficient	72
4.3.4 Determination of Optical Energy Gap (E_g)	73
4.3.5 Determination of Urbach Tail Bandwidth (E_e)	74
4.4 Effects of Argon dilution on Deposition Rates of a-Si:H Films	76
4.5 Effects of Argon Dilution on Refractive Index (n) of a-Si:H Films	78
4.6 Effects of Argon Dilution on Optical Energy Gap (E_g) of a-Si:H Films	80
4.7 Effects of Argon Dilution on Urbach Tail Bandwidth (E_e) of a-Si:H Films	82
4.8 Effects of Argon to Silane Flow-rate Ratio on Optical Energy Gap, Refractive Index and Urbach Tail Bandwidth(E_e)	82
4.9 Conclusion	84
References	90

Chapter 5 ATOMIC FORCE MICROSCOPY(AFM) STUDY ON ARGON**DILUTION a-Si:H FILMS**

5.1	Introduction	91
5.2	AFM Images of a-Si:H : Effect of Argon Dilution	93
5.2.1	Effects of Argon flow-rate on Surface Morphology of a-Si:H Films on Crystal Silicon (c-Si) Substrate.	93
5.2.2	Effects of Argon flow-rate on Surface Morphology of a-Si:H films on Glass Substrate.	97
5.3	AFM Images of a-Si:H : Effect of Substrate	101
5.3.1	Effect of Substrate on High Argon Dilution a-Si:H Films.	101
5.3.2	Effect of Substrate on Low Argon Dilution a-Si:H Films.	105
5.4	Variation of Surface Roughness with Ar:SiH ₄ Flow-rates Ratio	106
5.5	Variation of Mean Grain Diameter with Ar: SiH ₄ Flow-rates Ratio.	111
5.6	Conclusion.	113
	References	114

CONCLUSION

Chapter 6	Conclusion	115
	References	119
	Appendix	120