

CONTENTS

CHAPTER-1 : GENERAL INTRODUCTION	Page No.
1.1. Introduction to Polymers	1
1.2. Interactions of Radiations with Polymers	3
1.2.1. With electrons	5
1.2.2. With Gamma rays	6
1.2.3. With neutrons	8
1.3. Radiation sources used in the present work	10
1.4. Physics of Free Radicals	11
1.5. Homopolymerization of Monomers	12
1.6. Cross-linking of Polymers	13
1.7. Chain-Scissioning of Polymers	14
1.8. Graft and Block Co-polymerization	17
1.9. Modification of Polymers	19
References	22
 CHAPTER-2 : STUDIES ON DOSIMETRY	
2.1. Introduction to Dosimetry	23
2.1.1. Ionization Chamber Dosimeter	23
2.1.2. Semiconductor Junction Dosimeter	24
2.1.3. Coloured Indicator Dosimetry	24
2.1.4. Plastic Dosimeter	25
2.1.4.1. <i>Photographic Film Plastic Dosimetry</i>	25
2.1.4.2. <i>Non-photographic Film Plastic Dosimetry</i>	27
2.1.5. Chemical Dosimeter	28
2.2. Main Objective of this work	29
2.3. Radiation Limits for Users	30
2.4. Fricke Dosimeter	31
2.4.1. Background Theory	32
2.4.2. Experimental Methods and Analysis	33
2.4.3. Calculation of Absorbed Dose and Dose Rate	34

2.5.	Pocket Dosimeter as Health Monitor used in the Microtron Laboratory	39
2.5.1.	Working Principle and Construction	39
2.5.2.	Experimental Measurements	40
2.5.3.	Results and Conclusion	41
2.6.	Sensitivity Improvement for 14 MeV Neutrons	42
2.6.1.	Importance of the Work	42
2.6.2.	Experimental and Measurements	43
2.6.3.	Results and Discussion	47
	References	50

CHAPTER-3 : STUDIES ON CHARGE DYNAMICS IN POLYMERS

3.1.	Introduction to Charge Dynamics	52
3.2.	Background Theory	53
3.3.	Effects of 1 MeV Electron Irradiation on Residual Voltage of Perspex	55
3.3.1.	Importance of the work	55
3.3.2.	Introduction on Residual Voltage	56
3.3.3.	Theoretical Background of Residual Voltage	57
3.3.4.	Experimental Techniques	62
3.3.5.	Results and Discussion	64
3.3.6.	Conclusion	68
	References	69

CHAPTER-4 : STUDIES ON RADIATION INDUCED GRAFTING

4.1.	Theory of Grafting	70
4.2.	Effect of neutrons, electrons and gamma-radiation on grafting of Benzyl Alcohol onto Nylon(6)	76
4.2.1.	Main objective of this work	76
4.2.2.	Experimental Techniques	77
4.2.3.	Results and Discussion	79

4.3.	Radiation Induced Grafting of Benzyl Alcohol onto Liquid Nitrogen Processed Nylon (6)	83
4.3.1.	Importance of LN ₂ processing	83
4.3.2.	Experimental Techniques	85
4.3.3.	Results and Discussion	86
4.4.	Grafting of Acrylonitrile onto High Density Polyethylene by the Neutron Activation Analysis Technique	87
4.4.1.	Importance of the work	87
4.4.2.	Experimental Techniques	89
	4.4.2.1. <i>Sample Preparation</i>	89
	4.4.2.2. <i>Estimation of Nitrogen in Grafted HDPE</i>	90
4.4.3.	Results and Discussion	91
4.5.	Radiation Assisted Grafting of Vinylidene Chloride onto High Density Polyethylene	96
4.5.1.	Importance of the work	96
4.5.2.	Experimental Details	97
	4.5.2.1. <i>Sample Preparation</i>	97
	4.5.2.2. <i>The Grafting Process</i>	98
	4.5.2.3. <i>Conductivity Measurements</i>	99
	4.5.2.4. <i>Estimation of the Chlorine Content in the grafted HDPE samples</i>	100
4.5.3.	Results and Discussion	102
4.6.	Conclusion	108
	References	109

CHAPTER-5 : IRRADIATION EFFECTS ON THE ELECTRICAL AND OPTICAL PROPERTIES OF POLYMERS

5.1.	Theory of Electrical Conductivity of Polymers	112
5.2.	Radiation Induced Electrical Conductivity (RIEC) of Polymers	118

5.2.1.	Introduction to RIEC	118
5.2.2.	Experimental Techniques	121
5.2.3.	Results and Discussion	125
5.3.	Chemical Processing and Lithium Induced Electrical Conductivity (LIEC) of Polymers	129
5.3.1.	Introduction to LIEC	129
5.3.2.	Experimental Techniques	131
5.3.3.	Results and Discussion	132
5.4.	Irradiation Effects on the Optical Properties of Polymers	137
5.4.1.	General Background Theory	137
5.4.2.	Experimental Techniques	138
5.4.3.	Results and Discussion	139
	References	143
	* Concluding Remarks	147
	* Future Plans	148
	* Appendixes	150
	* List of Publications	161