List of Figures

Figure 1.1	Thermoplastic polymer.	06
Figure 1.2	Thermosetting polymer.	06
Figure 1.3	Elastomers.	07
Figure 1.4	Linear polymer.	07
Figure 1.5	Branched polymer.	08
Figure 1.6	Crosslinked polymer.	08
Figure 1.7	Network polymer.	09
Figure 1.8	Comparison between Electronic and Nuclear stopping of	
	Swift heavy ion.	14
Figure 1.9	Atomic number (Z) versus Photon energy (E) diagram.	15
Figure 1.10	Schematic representation of Photoelectric effect.	16
Figure 1.11	Schematic representation of Compton effect.	16
Figure 1.12	Pictorial representation of Pair production process	17
Figure 2.1	Schematic diagram of sample preparation method.	40
Figure 2.2	15 UD Pelletron accelerator at IUAC, New Delhi.	42
Figure 2.3	Beam line for material irradiation.	42
Figure 2.4	Irradiation chamber of Material science.	43
Figure 2.5	Sample holder for SHI irradiation at IUAC, New Delhi.	45
Figure 2.6	Gamma chamber 1200 at IUAC, New Delhi.	46
Figure 2.7	Reflection of X-rays from two parallel planes of atoms in	
-	a crystal	47
Figure 2.8	Bruker D8 advance x-ray diffractometer.	48
Figure 2.9	JASCO – 4600 Fourier Transform Infra-Red	
	spectrometers.	49
Figure 2.10	JASCO V-730 spectrophotometer.	51
Figure 2.11	Shimadzu RF-5301 spectrofluorophotometer.	52
Figure 2.12	Thermofisher – Harshaw TLD reader (Model HT 3500).	54
Figure 2.13	A parallel combination of capacitance and resistance.	54
Figure 2.14	Nyquist plot.	55
Figure 2.15	LCR meter (Agilent – 16452A).	57

Figure 2.16	Differential scanning calorimetry (SII EXSTAR 6000,	
	DSC 6220).	58
Figure 2.17	AFM set up at IUAC, New Delhi.	59
Figure 3.1	XRD patterns of PS/ Al ₂ O ₃ films.	66
Figure 3.2	XRD patterns of Al ₂ O ₃ nanoparticles.	67
Figure 3.3	EDAX spectrum of PA2.	68
Figure 3.4	EDAX spectrum of PA4.	68
Figure 3.5	The FTIR spectra of pristine and irradiated polymeric	
	films in the range of 700-1750 cm ⁻¹ .	69
Figure 3.6	The FTIR spectra of pristine and irradiated polymeric	
	films in the range of 420-500 cm^{-1} .	70
Figure 3.7	The FTIR spectra of pristine and irradiated polymeric	
	films in the range of 2500-3500 cm^{-1} .	70
Figure 3.8	The absorption spectra of pure and doped PS and	
	irradiated PA4.	72
Figure 3.9	PL excitation spectra of PS at emission wavelength of	
	435 nm.	74
Figure 3.10	PL emission spectra of pristine and irradiated PS-based	
	polymer nanocomposites at emission wavelength of 380	
	nm.	74
Figure 3.11	Gaussian fitting of photoluminescence emission	
	spectrum of pure polystyrene.	75
Figure 3.12	TL glow curves of gamma-irradiated polymer	
	composites.	76
Figure 3.13	TL glow curves of 90 MeV Carbon ions irradiated	
	polymer composites.	76
Figure 3.14	GCD fitting of TL glow curves of (a) PA4(50 kGy) (b)	
	PA4(1x10 ¹²).	78
Figure 3.15	Dielectric constant vs frequency of polymer	
	nanocomposites with the concentration of filler and the	
	dose.	80

Figure 3.16	Variation in dielectric loss versus frequency for polymer	
	nanocomposites with the concentration of filler and dose.	81
Figure 3.17	Variation in a. c. conductivity with frequency for	
	polymer nanocomposites at various filler concentrations	
	and doses.	82
Figure 3.18	DSC thermograms of PS, pristine and irradiated PA4.	83
Figure 3.19	AFM images of (a) PS (b) PA4 (c) PA4 (50 kGy) and (d)	
	PA4 (1x 10 ¹²).	84
Figure 4.1	XRD spectra of pristine and irradiated polymer	
	composites.	93
Figure 4.2	FTIR spectra of (a) PS, (b) PSE1,(c) PSE3, (d) PSE5, (e)	
	PSE5 (1 x 10 ¹¹), (f) PSE5 (1 x 10 ¹²).	95
Figure 4.3	Optical response of pre and post-irradiated-films.	96
Figure 4.4	Photoluminescence excitation spectrum of PS/Eu ₂ O ₃	
	nanocomposites.	99
Figure 4.5	Photoluminescence emission spectra of pristine	
	polystyrene composite films.	99
Figure 4.6	Photoluminescence emission spectra of (a) PSE5 film	
	irradiated with gamma rays at dose of 25 kGy and 50	
	kGy (b) magnified peaks in the range of 580-650 nm.	100
Figure 4.7	Photoluminescence emission spectra of PSE5 film	
	irradiated with SHI at the fluence of 1×10^{11} and 1×10^{12}	
	ions/cm ² .	100
Figure 4.8	TL glow curves of gamma irradiated polymer	
	nanocomposites.	102
Figure 4.9	TL glow curve for 90 MeV carbon ion beam irradiated	
	polymeric films.	102
Figure 4.10	GCD fitting of TL glow curve of 50 kGy gamma rays	
	irradiated PSE5 polymer composites.	103
Figure 4.11	GCD fitting of TL glow curve of 90 MeV carbon ion	
	irradiated PSE5(1x10 ¹²) polymer composites.	103

Figure 4.12	Dielectric constant vs log frequency for PS/Eu ₂ O ₃	
	polymer composites.	105
Figure 4.13	Dielectric loss vs log frequency for PS/Eu ₂ O ₃ polymer	
	composites.	106
Figure 4.14	Conductivity vs log frequency for PS/Eu ₂ O ₃ polymer	
	composites.	107
Figure 4.15	DSC thermograms of pristine and irradiated PSE films.	108
Figure 4.16	AFM of (a) PS, (b) PSE5 and (c) PSE5 (50 kGy) (d)	
	PSE5 $(1x10^{12})$.	109
Figure 5.1	XRD pattern of PVA and pristine PHS nanocomposite	
	polymer electrolytes.	119
Figure 5.2	XRD pattern of irradiated PHS10 nanocomposite	
	polymer electrolytes.	119
Figure 5.3	FTIR spectrum of pure PVA.	120
Figure 5.4	FTIR spectra of Pure PVA and PHS nanocomposite	
	polymer electrolytes.	121
Figure 5.5	FTIR spectra of gamma rays and SHI irradiated PHS10	
	nanocomposite polymer electrolytes.	121
Figure 5.6	Absorption spectra of PVA and pristine PHS	
	nanocomposite polymer electrolytes.	123
Figure 5.7	Absorption spectra of gamma and SHI irradiated PHS10	
	nanocomposite polymer electrolytes.	123
Figure 5.8	Frequency-dependent dielectric constant of PVA and	
	pristine PHS nanocomposite polymer electrolytes.	126
Figure 5.9	Frequency-dependent dielectric constant of irradiated	
	PHS10 nanocomposite polymer electrolytes.	126
Figure 5.10	Frequency-dependent dielectric loss of PVA and pristine	
	PHS nanocomposite polymer electrolytes.	127
Figure 5.11	Frequency-dependent dielectric loss of irradiated PHS10	
	nanocomposite polymer electrolytes.	127
Figure 5.12	Cole-Cole plot of pristine and irradiated PHS	
	nanocomposite polymer electrolytes.	128

Figure 5.13	Frequency-dependent AC conductivity of PVA and	
	Pristine PHS nanocomposite polymer electrolytes.	130
Figure 5.14	Frequency-dependent AC conductivity of PVA and	
	irradiated PHS10 nanocomposite polymer electrolytes.	130
Figure 5.15	DSC thermogram of pristine and irradiated PHS10	
	Nanocomposite polymer electrolytes.	132
Figure 5.16	AFM image of (a) PHS10, (b) PHS10 (50 kGy) (c)	
	PHS10 (1 x 10 ¹²).	134
Figure 6.1	Comparison of PL emission spectra of pristine and	
	irradiated PS/Al ₂ O ₃ nanocomposites.	144
Figure 6.2	Comparison of gamma rays and SHI irradiations on	
	intensity of PL emission peak of Eu^{3+} ion (612 nm).	144
Figure 6.3	Effect of Gamma and SHI irradiation on TL glow curve	
	intensity of PS/Al ₂ O ₃ nanocomposites	145
Figure 6.4	Effect of Gamma and SHI irradiation on TL glow cure	
	intensity of PS/Eu ₂ O ₃ nanocomposites.	146
Figure 6.5	Comparison of the effect of Gamma rays and SHI	
	irradiation on the dielectric constant of PS/Al_2O_3 and	
	PS/Eu ₂ O ₃ polymer nanocomposites.	147
Figure 6.6	Comparison of the effect of Gamma rays and SHI	
	irradiation on the dielectric loss of PS/Al ₂ O ₃ and	
	PS/Eu ₂ O ₃ polymer nanocomposites.	147
Figure 6.7	Comparison of the effect of Gamma rays and SHI	
	irradiation on the dielectric constant of $PVA/H_3PO_4/SiO_2$	
	nanocomposite polymer electrolytes.	148
Figure 6.8	Comparison of the effect of Gamma rays and SHI	
	irradiation on the dielectric loss of $PVA/H_3PO_4/SiO_2$	
	nanocomposite polymer electrolytes.	148
Figure 6.9	Comparison of the effect of Gamma rays and SHI	
	irradiation on AC conductivity of PS/Al ₂ O ₃ and	
	PS/Eu ₂ O ₃ polymer nanocomposites.	149

Figure 6.10	Comparison of the effect of Gamma rays and SHI	
	irradiation on AC conductivity of PVA/H ₃ PO ₄ /SiO ₂	
	nanocomposite polymer electrolytes	150