List of Figures

Chapter – I	
Fig. 1.1 Graph for projectile ion energy versus energy loss	10
Fig. 1.2 Schematic of ion-solid interaction induced cascade collision	10
Fig. 1.3 Interaction of ion beam with target material	13
Chapter – II	
Fig. 2.1 Schematic of Pelletron accelerator	49
Fig.2.2 Materials Science Chamber for Irradiation	50
Fig. 2.3 Schematic of Bragg's law	57
Fig.2.4 Schematic of x-ray diffraction geometries (a) reflection mode (b) transmis mode	ssion 58
Fig. 2.5 Schematic of DSC	60
Fig. 2.6 Energy levels diagram	62
Fig. 2.7 Instrumentation of UV-vis spectrometer	63
Fig. 2.8 Schematic and working of SEM	65
Fig. 2.9 Basic of SQUID	68
Fig. 2.10 Impedance phase gain analyzer (Solartron 1260)	70
Fig. 2.11 Representation of complex permittivity	72

Fig. 2.12 Polarization in Dielectric (a) vacuum capacitor, (b) polarised dipoles in the dielectric inserted between the capacitor plates, (c) random dipoles when no electric field is applied 74

Chapter – III

Fig. 3.1 X-ray diffraction patterns of (a) silver nanoparticles, (b) PMMA+ Ag (pristine), (C) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (d) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (f) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 83

Fig. 3.2 DSC thermo grams for (a) Pure and composites, (b) Composites for C beam, (c) Composites for Si beam 86

Fig. 3.3 Absorbance spectra for (a) pristine (b) irradiated by C-beam (c) irradiated by Si- beam 89

Fig. 3.4(a-f) SEM Images for (a) Pure PMMA (b) PMMA irradited (C beam) (c) PMMA+15% Ag (d) PMMA+15% Ag (C Beam) (e) PMMA+15% Ag (Si beam) (f) Ag nanoparticles 91

Fig. 3.5 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 94

Fig. 3.6 Dielectric constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 97

Fig. 3.7 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 100

Fig. 3.8 X-ray diffraction patterns of (a) PS+ Ag (pristine), (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 103

Fig. 3.9 DSC thermo grams for (a) pristine (b) Irradiated by C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (C) Irradiated by Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 106

Fig. 3.10 Absorbance spectra of (a) Pristine (b) Irradiated by C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) Irradiated by C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Irradiated by Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Irradiated by Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 110

Fig. 3.11 SEM Images for (a) Pure PS (b) PS irradited (C beam) (c) PS+15% Ag(pristine) (d) PS+15% Ag (C Beam) (e) PS+15% Ag (Si beam)113

Fig. 3.12 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 116

Fig. 3.13 Dielectric Constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 119

Figure 3.14 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 122

Fig. 3.15 Comparison of conductivity of pristine and irradiated samples at 10 MHz

125

Fig. 3.16 Comparison of dielectric constant of pristine and irradiated samples at 10 MHz 126

Chapter – IV

Fig. 4.1 X-ray diffraction patterns of (a) copper nanoparticles (b) pure PMMA (c) PMMA+ Cu(pristine) (d) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (f) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (g) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 134

Fig. 4.2 DSC spectra of (a) composites (b) irradiated films $(1 \times 10^{12} \text{ ions/cm}^2)$ 137

Fig. 4.3 Absorbance spectra for (a) PMMA+ Cu(pristine) (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 139

Fig. 4.4 SEM images of (a) PMMA+ 15 % Cu (pristine) (b) PMMA + 15 % Cu (Cbeam) (c) PMMA + 15 % Cu (Si beam) and (d) Copper nanoparticles142

Fig. 4.5 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 145

Fig. 4.6 Dielectric constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 148

Fig. 4.7 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 151

Fig 4.8 X-ray diffraction patterns of (a) PS+ Cu (pristine) (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 154

Fig. 4.9 DSC spectra of pure, composites and irradiated $(1 \times 10^{12} \text{ ions/cm}^2)$ films 155

Fig. 4.10 Absorbance spectra for (a) PS+ Cu(pristine), (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 158

Fig. 4.11 SEM images of (a) PS+ 15 % Cu (pristine) (b) PS + 15 % Cu (C beam- 1 x 10^{12}) (c) PS + 15 % Cu (Si beam- 1 x 10^{12}) 161

Fig. 4.12 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 164

Fig. 4.13 Dielectric Constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (f) I for the formula of the formula o Fig. 4.14 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $\times 10^{12} \text{ ions/cm}^2)$ 170

Fig. 4.15 Comparison of conductivity of pristine and irradiated samples at 10 MHz

173

194

Fig. 4.16 Comparison of Dielectric Constant of pristine and irradiated samples at 10 MHz 174

Chapter – V

Fig. 5.1 X-ray diffraction patterns of (a) nickel nanoparticles (b) pure PMMA (c) PMMA+ Ni(pristine), (d) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (f) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (g) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 183

Fig. 5.2 DSC curves for pristine and irradiated $(1 \times 10^{12} \text{ ions/cm}^2)$ samples 186

Fig. 5.3 Absorbance spectra for (a) PMMA+ Ni (pristine) (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 189

Fig. 5.4 SEM images of (a) PMMA+ 15 % Ni (pristine) (b) PMMA + 15 % Ni (Cbeam) (c) PMMA + 15 % Ni (Si beam) and (d) Nickel nanoparticles191

Fig. 5.5 M-H loop for pristine and irradiated samples

Fig. 5.6 FC- ZFC magnetization for pristine and irradited samples 194

Fig. 5.7 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 197

Fig. 5.8 Dielectric constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 200

Fig. 5.9 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 203

Fig 5.10 X-ray diffraction patterns of (a) PS+ Ni (pristine) (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 206

Fig. 5.11 DSC spectra for (a) Pristine (b) C beam (c) Si beam composites 209

Fig. 5.12 Absorbance spectra of (a) Pristine (b) C beam (c) Si beam composites 212

Fig. 5.13 SEM images of (a) PS+	15 % Ni (pristine) (b) $PS + 1$	15 % Ni (C beam) (c)
PS + 15 % Ni (Si beam)		214

Fig. 5.14 M-H curves for pristine and irradiated samples 216

Fig. 5.15 ZFC-FC curves for pristine and irradiated samples 217

Fig. 5.16 Conductivity Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 220

Fig. 5.17 Dielectric Constant Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 223

Fig. 5.18 Dielectric loss Vs Log f for (a) pristine (b) C beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (c) C beam $(1 \times 10^{12} \text{ ions/cm}^2)$ (d) Si beam $(1 \times 10^{11} \text{ ions/cm}^2)$ (e) Si beam $(1 \times 10^{12} \text{ ions/cm}^2)$ 226

Fig. 5.19 Comparison of conductivity of pristine and irradiated samples at 10 MHz

229

Fig. 5.20 Comparison of dielectric constant of pristine and irradiated samples at 10 MHz 230

Chapter – VI

Fig.6.1 Comparison of conductivity of pristine and irradiated samples at 10 MHz 244

Fig. 6.2 Comparison of dielectric constant of pristine and irradiated samples at 10 MHz 248