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ABSTRACTS

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E-P3

Electron-beam irradiation on polymer nanomaterials

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We report on the effects of electron (E)-beam irradiation on the optical and electrical properties of π-conjugated polymer nanomaterials and their application to nano-devices. π-Conjugated polymer nanomaterials such as light emitting poly (3-methylthiopnehe) (P3MT) nanotubes and conducting polypyrrole (PPy) nanowires were synthesized through the electrochemical polymerization method. Unfocused E-beam generated from linear electron accelerator was irradiated on the polymer nanomaterials. The energies and the dosages of the unfocused E-beam irradiation in an atmospheric environment, varied from 300 keV to 2 MeV and from 1.6×10^{13} to 8.0×10^{16} electrons/cm^2, respectively. Focused E-beam generated from E-beam lithography instrument was also irradiated on the intended area of single strand of PPy nanowires. The dosages of the focused E-beam irradiation under relatively high vacuum condition ($\leq 10^{-5}$ torr) varied from 1.0×10^{15} to 1.0×10^{19} electrons/cm^2. To discern conformational changes due to the E-beam irradiation, Raman spectra of the pristine and E-beam irradiated polymer nanomaterials were compared in the conditions of E-beam irradiation. From ultraviolet-visible absorption spectra, we observed that the π-π* transition peak and the doping induced polaron and bipolaron peaks of the polymer nanomaterials varied with the energy and/or dosage of E-beam irradiation. From the laser confocal microscope (LCM) photoluminescence (PL) images and spectra for the single strands of P3MT nanotubes, we observed the significant red-shift of LCM PL peaks and enhancements in the LCM PL intensity of P3MT nanotubes through relatively high energy E-beam irradiation [1]. Comparing of the current-voltage (*I-V*) characteristics between the pristine and E-beam irradiated PPy nanowires, the resistance of PPy nanowires gradually increased as the energy and/or dosage of E-beam increased [2]. We suggest that the variation of optical and electrical properties of π-conjugated polymer nanomaterials might have originated from conformational change and dedoping effect, produced by the E-beam irradiation.

[1] Y. K. Hong and J. Joo, *et al.*, Adv. Funct. Mater. in press (2009)
[2] Y. K. Hong and J. Joo, *et al.*, Appl. Phys. Lett. in press (2009).