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Improvement of polypyrrole nanowire devices by plasmonic space charge generation: high photocurrent and wide spectral response by Ag nanoparticle decoration[1] SEUNG-HOON LEE, Department of Physics, Pukyong National University, SEUNG WOO LEE, School of Chemical Engineering, Yeungnam University, JAW-WON JANG[2], Department of Physics, Pukyong National University — In this study, improvement of the opto-electronic properties of non-single crystallized nanowire devices with space charges generated by localized surface plasmon resonance (LSPR) is demonstrated. The photocurrent and spectral response of single polypyrrole (PPy) nanowire (NW) devices are increased by electrostatically attached Ag nanoparticles (Ag NPs). The photocurrent density is remarkably improved, up to 25.3 times, by the Ag NP decoration onto the PPy NW (PPy_{AgNPs} NW) under blue light illumination. In addition, the PPy_{AgNPs} NW shows a photocurrent decay time twice that of PPy NW, as well as an improved spectral response of the photocurrent. The improved photocurrent efficiency, decay time, and spectral response resulted from the space charges generated by the LSPR of Ag NPs. Furthermore, the increasing exponent (m) of the photocurrent ($J_{PC} \sim V_m$) and finite-differential time domain (FDTD) simulation straightforwardly indicate relatively large plasmonic space charge generation.

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