Novel Circularly Polarized Light-Sensing Near-Infrared Organic Phototransistors Based on Chiroptical Narrow Bandgap π-Conjugated Polymer Thin-Films

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Chiral photonics using circularly polarized (CP) light has attracted significant attention as a key technology for next-generation optoelectronics such as quantum computing, high-performance displays, encryption, bio sensor, 3D imaging and spintronic devices. In order to accomplish the practical applications of CP light, CP light-sensing photodetectors that generate discriminating electrical signals depending on chiroptical properties of the device should be developed. In particular, CP light-sensing photodetectors functioning at near-infrared (NIR) region[1] are of vital improtant becuase it provides an opportunity to fully expand the application scope of CP light including optical communications. For this, very recently, as a part for the effort to develop high-performance NIR CP light-sensing photodetectors, we newly synthesized chiroptical narrow bandgap π-conjugetd polymers bearing enantiopure side chains, which show high absorption coefficient in NIR region and excellent charge transport property simultaneouly. In this work, the chiroptical properties of chiral sidechain conjugated polymer, which are typically featured to the supramolecular self-assembly of polymer chains, were investigated using various spectroscopic and structural analysis in the solid state. In addition, by introducing the chiroptical polymer thin films as a NIR photoactive channel layer, CP light-sensing organic phototransistors (OPTRs) operating in NIR region were fabricated and their photoresponse characteristics were explored.

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