

High Performance Organic Near-Infrared Photodetectors Enabled by Developing Asymmetrical Low-Bandgap Nonfullerene Acceptors

이재원[†], 오필건¹충남대학교; ¹부경대학교(jaewonlee@cnu.ac.kr[†])

Sensitive detection of NIR light enables diverse applications in both research and industry. Low-bandgap molecular semiconductors are relevant as key materials for solution-processed near-infrared (NIR) organic photodetectors (OPDs) due to the tunability of their energy levels and absorption properties through molecular design. We thus designed and synthesized low-bandgap nonfullerene electron acceptors (NFAs), which exhibit thin film absorbances that span from 600 nm to 1100 nm. As a preliminary assessment of NIR light sensing as a practical application, we carried out a simple photoplethysmography (PPG) test using our OPDs. The present OPDs could achieve a high maximum responsivity over 0.5 A W^{-1} in the NIR region beyond 900 nm, marking one of the highest responsivity achieved by organic photodiodes in the NIR spectrum. Moreover, with suppressed injection dark current for the thicker active layer device, an excellent D_{sh}^* of 3.31×10^{13} Jones can be obtained. The excellent performance highlights the potential of the present OPDs as an efficient low-cost alternative to the commercialized inorganic photodetectors for NIR sensing.