UV-Light Sensitive Transparent Organic Solar Cells

Lin, Cheng-Pei

In this report, two ultraviolet (UV)-light absorption molecules (D2, A2) were synthesized. Organic solar cell (OSC) based on these two molecules were fabricated and studied. The electron-donating molecule D2 and electron-accepting molecule A2 were synthesized by introducing diphenylamino group and 1,3,4-oxadiazole heterocyclic group to the 9,9'-spirobifluorene core, respectively. Both D2 and A2 molecules absorb ultraviolet (UV)-light (< 400 nm) with high absorbance and also show high transmittance to visible lights. The energy level alignments between D2 and A2 make efficient photo-induced electron transfer from D2 to A2 feasible. Vacuum-processed OSC with the active layer of D2:A2 (1:1) blended thin film demonstrated power conversion efficiency (PCE) up to 15.6% under irradiation of an indoor multi-light source. The obtained efficiency is the best ever reported for a UV-sensitive OSC. A transparent OSC based on D2:A2 (1:1) blended thin film has also been fabricated. This UV-sensitive OSC, unlike the commercially available dark blue silicon-based solar cells, is colorless and therefore transparent to human eyes. With good transparence and high efficiency under weak light intensity, this OSC has the potential to be installed in residential building. In addition, because of the ability of converting UV-light into electric current, this UV-sensitive OSC also has the potential to be used as a UV sensor to detect harmful UV-light under various conditions.

Awards Won:

Third Award of $1,000

SPIE, the international society for optics and photonics: First Award of $3,000