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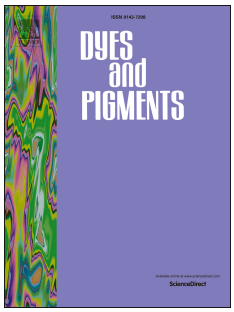

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Asymmetric, efficient π-conjugated organic semiconducting chromophore for bulk-heterojunction organic photovoltaics

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Abstract

A novel, asymmetric benzothiadiazole-core π-conjugated organic semiconducting chromophore (CF-BTz-ThR) containing an alkyl bithiophene donor and 3,5-bis (trifluoromethyl) benzene as acceptor unit was synthesized via Suzuki cross-coupling in a relatively cost-effective way. The synthesized chromophore was applied as an electron-donor material in the solution-processed fabrication of bulk heterojunction (BHJ) organic photovoltaics (OPVs). The presence of terminal hexyl chain in CF-BTz-ThR induced its solubility in common organic solvents. The energy levels of CF-BTz-ThR were calculated as −5.22 eV and −3.19 eV for HOMO and LUMO, respectively. The fabricated devices attained power conversion efficiency (PCE) of ~3.52 % for CF-BTz-ThR: $PC_{61}BM$ (1:3, w/w) ratio with the short circuit current (J_{SC}) of ~10.38 mA/cm^2 and the open-circuit voltage (V_{OC}) of ~0.68 V. The reasonable J_{SC} and V_{OC} of the devices might be attributed to strong absorption and emission properties as well as the electrochemical properties due to the presence of strong electron-withdrawing benzothiadiazole as well as $–CF_3$ unit as electron-acceptor.

Keywords: Benzothiadiazole, 3,5-bis (trifluoromethyl) benzene, electrochemical properties, semiconducting chromophore, organic photovoltaics.

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