



Ring Substituents Mediate the Morphology of PBDTTPD-PCBM Bulk-Heterojunction Solar Cells

Submitted by Clément Cabanetos on Mon, 06/01/2015 - 14:55

Titre	Ring Substituents Mediate the Morphology of PBDTTPD-PCBM Bulk-Heterojunction Solar Cells
Type de publication	Article de revue
Auteur	Warnan, Julien [1], Labban, Abdulrahman El [2], Cabanetos, Clément [3], Hoke, Eric T [4], Shukla, Pradeep Kumar [5], Risko, Chad [6], Brédas, Jean-Luc [7], McGehee, Michael D [8], Beaujuge, Pierre M [9]
Pays	Etats-Unis
Editeur	American Chemical Society
Ville	Washington
Type	Article scientifique dans une revue à comité de lecture
Année	2014
Langue	Anglais
Date	08/04/2014
Numéro	7
Pagination	2299-2306
Volume	26
Titre de la revue	Chemistry of Materials
ISSN	0897-4756

Résumé en anglais

Among π -conjugated polymer donors for efficient bulk-heterojunction (BHJ) solar cell applications, poly(benzo[1,2-*b*:4,5-*b'*]dithiophene-thieno[3,4-*c*]pyrrole-4,6-dione) (PBDTTPD) polymers yield some of the highest open-circuit voltages (V_{oc} , ca. 0.9 V) and fill-factors (FF, ca. 70%) in conventional (single-cell) BHJ devices with PCBM acceptors. In PBDTTPD, side chains of varying size and branching affect polymer self-assembly, nanostructural order, and impact material performance. However, the role of the polymer side-chain pattern in the intimate mixing between polymer donors and PCBM acceptors, and on the development of the BHJ morphology is in general less understood. In this contribution, we show that ring substituents such as furan (F), thiophene (T) and selenophene (S)—incorporated into the side chains of PBDTTPD polymers—can induce significant and, of importance, very different morphological effects in BHJs with PCBM. A combination of experimental and theoretical (via density functional theory) characterizations sheds light on how varying the heteroatom of the ring substituents impacts (i) the preferred side-chain configurations and (ii) the ionization, electronic, and optical properties of the PBDTTPD polymers. In parallel, we find that the PBDT(X)TPD analogs (with X = F, T, or S) span a broad range of power conversion efficiencies (PCEs, 3–6.5%) in optimized devices with improved thin-film morphologies via the use of 1,8-diiodooctane (DIO), and discuss that persistent morphological impediments at the nanoscale can be at the origin of the spread in PCE across optimized PBDT(X)TPD-based devices. With their high $V_{oc} \sim 1$ V, PBDT(X)TPD polymers are promising candidates for use in the high-band gap cell of tandem solar cells.

URL de la notice <http://okina.univ-angers.fr/publications/ua12132> [10]
DOI [10.1021/cm500172w](https://doi.org/10.1021/cm500172w) [11]
Lien vers le document <http://dx.doi.org/10.1021/cm500172w> [11]
Titre abrégé Chem. Mater.

Liens

- [1] [http://okina.univ-angers.fr/publications?f\[author\]=21147](http://okina.univ-angers.fr/publications?f[author]=21147)
- [2] [http://okina.univ-angers.fr/publications?f\[author\]=21118](http://okina.univ-angers.fr/publications?f[author]=21118)
- [3] <http://okina.univ-angers.fr/clement.cabanetos/publications>
- [4] [http://okina.univ-angers.fr/publications?f\[author\]=21126](http://okina.univ-angers.fr/publications?f[author]=21126)
- [5] [http://okina.univ-angers.fr/publications?f\[author\]=21164](http://okina.univ-angers.fr/publications?f[author]=21164)
- [6] [http://okina.univ-angers.fr/publications?f\[author\]=21165](http://okina.univ-angers.fr/publications?f[author]=21165)
- [7] [http://okina.univ-angers.fr/publications?f\[author\]=21166](http://okina.univ-angers.fr/publications?f[author]=21166)
- [8] [http://okina.univ-angers.fr/publications?f\[author\]=21123](http://okina.univ-angers.fr/publications?f[author]=21123)
- [9] [http://okina.univ-angers.fr/publications?f\[author\]=21124](http://okina.univ-angers.fr/publications?f[author]=21124)
- [10] <http://okina.univ-angers.fr/publications/ua12132>
- [11] <http://dx.doi.org/10.1021/cm500172w>

Publié sur *Okina* (<http://okina.univ-angers.fr>)