Interplay Between Side Chain Pattern, Polymer Aggregation, and Charge Carrier Dynamics in PBDTTPD: PCBM Bulk-Heterojunction Solar Cells

Titre	Interplay Between Side Chain Pattern, Polymer Aggregation, and Charge Carrier Dynamics in PBDTTPD: PCBM Bulk-Heterojunction Solar Cells
Type de publication	Article de revue
Auteur	Dyer-Smith, Clare [1], Howard, Ian A [2], Cabanetos, Clément [3], Labban, Abdulrahman El [4], Beaujuge, Pierre M [5], Laquai, Frédéric [6]
Pays	Allemagne
Editeur	Wiley-VCH Verlag
Ville	Weinheim
Type	Article scientifique dans une revue à comité de lecture
Année	2015
Langue	Anglais
Date	06/05/2015
Numéro	9
Volume	5
Titre de la revue	Advanced Energy Materials
ISSN	1614-6832
Mots-clés	bulk-heterojunction solar cells [7], charge carrier dynamics [8], polymer solar cells [9], structure–property relationships [10], transient absorption spectroscopy [11]
Résumé en anglais	Poly(benzo[1,2-*b*:4,5-*b*′]dithiophene–*alt*–thieno[3,4-*c*]pyrrole-4,6-dione) (PBDTTPD) polymer donors with linear side-chains yield bulk-heterojunction (BHJ) solar cell power conversion efficiencies (PCEs) of about 4% with phenyl-C_{71}-butyric acid methyl ester (PC71BM) as the acceptor, while a PBDTTPD polymer with a combination of branched and linear substituents yields a doubling of the PCE to 8%. Using transient optical spectroscopy it is shown that while the exciton dissociation and ultrafast charge generation steps are not strongly affected by the side chain modifications, the polymer with branched side chains exhibits a decreased rate of nongeminate recombination and a lower fraction of sub-nanosecond geminate recombination. In turn the yield of long-lived charge carriers increases, resulting in a 33% increase in short circuit current (J_{sc}). In parallel, the two polymers show distinct grazing incidence X-ray scattering spectra indicative of the presence of stacks with different orientation patterns in optimized thin-film BHJ devices. Independent of the packing pattern the spectroscopic data also reveals the existence of polymer aggregates in the pristine polymer films as well as in both blends which trap excitons and hinder their dissociation.
URL de la notice	http://okina.univ-angers.fr/publications/ua12126 [12]
DOI	10.1002/aenm.201401778 [13]

Lien vers le document	http://dx.doi.org/10.1002/aenm.201401778 [13]
Titre abrégé	Adv. Energy Mater.

Liens
[1] http://okina.univ-angers.fr/publications?f[author]=21138
[2] http://okina.univ-angers.fr/publications?f[author]=21139
[3] http://okina.univ-angers.fr/clement.cabanetos/publications
[4] http://okina.univ-angers.fr/publications?f[author]=21118
[5] http://okina.univ-angers.fr/publications?f[author]=21124
[6] http://okina.univ-angers.fr/publications?f[author]=21140
[7] http://okina.univ-angers.fr/publications?f[keyword]=18102
[8] http://okina.univ-angers.fr/publications?f[keyword]=18103
[9] http://okina.univ-angers.fr/publications?f[keyword]=18104
[10] http://okina.univ-angers.fr/publications?f[keyword]=16097
[11] http://okina.univ-angers.fr/publications?f[keyword]=18105
[12] http://okina.univ-angers.fr/publications/ua12126
[13] http://dx.doi.org/10.1002/aenm.201401778