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Improving the long-term stability of PBDTTPD polymer solar cells through material purification aimed at removing organic impurities

Submitted by Clément Cabanetos on Mon, 06/01/2015 - 14:41

Titre	Improving the long-term stability of PBDTTPD polymer solar cells through material purification aimed at removing organic impurities
Type de publication	Article de revue
Auteur	Mateker, William R [1], Douglas, Jessica D [2], Cabanetos, Clément [3], Sachs-Quintana, I. T [4], Bartelt, Jonathan A [5], Hoke, Eric T [6], Labban, Abdulrahman El [7], Beaujuge, Pierre M [8], Fréchet, Jean MJ [9], McGehee, Michael D [10]
Pays	Royaume-Uni
Editeur	Royal Society of Chemistry
Type	Article scientifique dans une revue à comité de lecture
Année	2013
Langue	Français
Date	17/07/2013
Numéro	8
Pagination	2529-2537
Volume	6
Titre de la revue	Energy & Environmental Science
ISSN	1754-5692
Résumé en anglais	While bulk heterojunction (BHJ) solar cells fabricated from high M_n PBDTTPD achieve power conversion efficiencies (PCE) as high as 7.3%, the short-circuit current density (J_{SC}) of these devices can drop by 20% after seven days of storage in the dark and under inert conditions. This degradation is characterized by the appearance of S-shape features in the reverse bias region of current–voltage (*J*–*V*) curves that increase in amplitude over time. Conversely, BHJ solar cells fabricated from low M_n PBDTTPD do not develop S-shaped *J*–*V* curves. However, S-shapes identical to those observed in high M_n PBDTTPD solar cells can be induced in low M_n devices through intentional contamination with the TPD monomer. Furthermore, when high M_n PBDTTPD is purified via size exclusion chromatography (SEC) to reduce the content of low molecular weight species, the J_{SC} of polymer devices is significantly more stable over time. After 111 days of storage in the dark under inert conditions, the *J*–*V* curves do not develop S-shapes and the J_{SC} degrades by only 6%. The S-shape degradation feature, symptomatic of low device lifetimes, appears to be linked to the presence of low molecular weight contaminants, which may be trapped within samples of high M_n polymer that have not been purified by SEC. Although these impurities do not affect initial device PCE, they significantly reduce device lifetime, and solar cell stability is improved by increasing the purity of the polymer materials.
URL de la notice	http://okina.univ-angers.fr/publications/ua12122 [11]

DOI	10.1039/c3ee41328d [12]
Titre abrégé	Energy Environ. Sci.

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[2] http://okina.univ-angers.fr/publications?f[author]=21120
[3] http://okina.univ-angers.fr/clement.cabanetos/publications
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[12] http://dx.doi.org/10.1039/c3ee41328d

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