

Accepted Manuscript

Enhancement of organic photovoltaic device performance via P3HT:PCBM solution heat treatment

Francis Otieno, Bridget K Mutuma, Mildred Airo, Kamalakannan Ranganathan, Rudolph Erasmus, Neil Coville, Daniel Wamwangi



PII: S0040-6090(17)30057-3
DOI: doi: [10.1016/j.tsf.2017.01.047](https://doi.org/10.1016/j.tsf.2017.01.047)
Reference: TSF 35759
To appear in: *Thin Solid Films*
Received date: 18 March 2016
Revised date: 20 January 2017
Accepted date: 23 January 2017

Please cite this article as: Francis Otieno, Bridget K Mutuma, Mildred Airo, Kamalakannan Ranganathan, Rudolph Erasmus, Neil Coville, Daniel Wamwangi , Enhancement of organic photovoltaic device performance via P3HT:PCBM solution heat treatment. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Tsf(2017), doi: [10.1016/j.tsf.2017.01.047](https://doi.org/10.1016/j.tsf.2017.01.047)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Enhancement of organic photovoltaic device performance via P3HT:PCBM solution heat treatment.

Francis Otieno^{a,d}, Bridget K Mutuma^{b,c}, Mildred Airo^c, Kamalakannan Ranganathan^{b,c}, Rudolph Erasmus^{a,d}, Neil Coville^{b,c} and Daniel Wamwangi^{a,d}

^aMaterial Physics Research Institute, School of Physics, University of the Witwatersrand, Johannesburg 2050, South Africa.

^bMolecular Science Institute, School of Chemistry, University of the Witwatersrand, Private Bag 3, Wits 2050, South Africa

^cDST-NRF Centre of Excellence in Strong Materials and the Molecular Sciences Institute, University of the Witwatersrand, Johannesburg 2050, South Africa

^dMaterials for Energy Research group, University of the Witwatersrand, Private Bag 3, 2050 Wits, Johannesburg, South Africa.

Corresponding Author: Francis Otieno.

Email: frankotienoo@gmail.com

ABSTRACT

The efficiency of bulk heterojunction organic photovoltaic cells can be enhanced through heat treatment of the components of the blend solution. The morphology of films spun from the heat treated blend solution reveals a more favorable diffusion of [6,6]-phenyl-C61-butyric acid methyl ester into the Poly(3-hexylthiophene-2,5-diyl) matrix than observed in the separate heating of the individual solutions. Heat treatment of a Poly(3-hexylthiophene-2,5-diyl) solution showed an enhanced Raman intensity associated with structural ordering. Heating of the blend solution after pre-heating P3HT solution to form a bulk heterojunction (P3HT: PCBM) with a ratio of 1:1 leads to limited diffusion of the [6,6]-phenyl-C61-butyric acid methyl ester phase into the crystalline Poly(3-hexylthiophene-2,5-diyl) phase. This study showed that solution heat treatment of a P3HT:PCBM blend leads to structural ordering of the Poly(3-hexylthiophene-2,5-diyl) polymer which modified the optical, morphological, PL and Raman characteristics relative to highly ordered Poly(3-hexylthiophene-2,5-diyl). The high Poly(3-hexylthiophene-2,5-diyl) polymer crystallinity enhanced the red shifted optical absorption, narrowed the full width at half maximum of Raman peaks and decreased the photoluminescence intensity upon solution heat treatment. The efficiency of the Bulk heterojunction made from a solution heat treated blend has yielded maximum power

Download English Version:

<https://daneshyari.com/en/article/5466327>

Download Persian Version:

<https://daneshyari.com/article/5466327>

[Daneshyari.com](https://daneshyari.com)