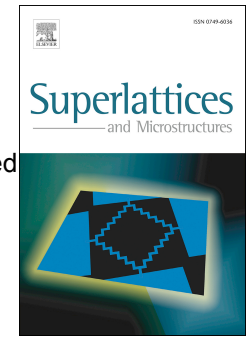
Accepted Manuscript



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PII: S0749-6036(18)30716-X

DOI: 10.1016/j.spmi.2018.06.037

Reference: YSPMI 5772

To appear in: *Superlattices and Microstructures*

Received Date: 8 April 2018

Revised Date: 19 June 2018

Accepted Date: 20 June 2018

Please cite this article as: A. Yadav, A. Upadhyaya, S.K. Gupta, A.S. Verma, C.M. Singh Negi, Solution processed graphene as electron transport layer for bulk heterojunction based devices, *Superlattices and Microstructures* (2018), doi: 10.1016/j.spmi.2018.06.037.

Solution Processed Graphene as Electron Transport Layer For Bulk Heterojunction based Devices

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ABSTRACT

The exceptional electrical properties of the graphene offer many opportunities for the performance improvement in the devices. In this study, the importance of incorporation of solution processed graphene as an electron transport layer (ETL) in bulk heterojunction (BHJ) devices is elucidated by measuring the current-voltage characteristics under dark and illumination conditions. Raman spectra P3HT:PCBM blend thin films display the same modes as of pristine P3HT. The UV/Vis analysis confirms the formation of P3HT:PCBM blend. The three different devices of architectures: standard structure, standard structure with ETL and inverted structure with ETL, comprising active layer of as-prepared P3HT:PCBM blends are fabricated and compared. Various Schottky diode parameters like ideality factor, series resistance, and barrier height are determined from current-voltage curves using Cheung and Cheung approach. The incorporation of graphene ETL in the device shows the enhancement in photocurrent resulting from the better extraction and improved charge collection efficiency. The photovoltaic effect is also observed for inverted device configuration. The charge transport analysis of the devices show overall power law trend, i.e. Ohmic current at low voltage followed by space charge limited conduction in existence of discrete trap levels at higher voltage range.

Keywords: Graphene; Bulk heterojunction; Electron transport layer; Absorption spectra; Current-Volatge characterstics; Chrage transport.

1. Introduction

Since last few decades, organic photovoltaics (OPVs) have been paid significant attention as a potential candidate for the generation of clean electricity. Other than power devices conjugated polymers, corresponding derivatives and their composites have been investigated and explored for their applications