Simulation of Organic Solar Cell at Different Charge Mobility and Different Series Resistances

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ABSTRACT

The organic solar cell has been simulated by GPVDM software at different charge carrier mobility and different series resistances. This device model consists of mixture of P3HT and PCBM materials as active layer. In this device ITO is a transparent electrode, PEDOT: PSS is buffer layer and Al is a back electrode. In this study the electrical and optical simulation has been done at different charge carrier mobility 0.75X10 -4 m2 v-1s-1, 0.75X10 -5 m2 v-1s-1 ,0.75X10 -6 m2 v-1s-1 , 0.75X10 -7 m2 v-1s-1 and different series resistances 1Ω , 3Ω ,5Ω and 7Ω .It is observed that J-V characteristics are affected by the charge carrier mobility and series resistance .We concluded that the maximum efficiency is obtained at charge carrier mobility 0.75X10 -6 m2 v-1s-1 and 1Ω series resistance tacking device thickness 250 nm.

Key words: *GPVDM software, Charge mobility, Series resistance, Bulk heterojunction, Organic solar cell.*

INTRODUCTION

Solar cell or photovoltaic cell is the device that converts solar energy into electrical energy. Every green plant leaves do similar work; they convert sunlight into chemical energy. A group of solar cell so called organic solar cells is an organic photovoltaic device, attracted more and more interest in last few years. Organic semiconductors have proved to be quite different material for organic photovoltaic solar (OPV) cell. OPV devices have several advantages like thin film structure, room temperature processing, flexible substrate, light weight, and low cost fabrication [Kreb er. al (2007) & Jain et. al (2007). Organic solar cells based on conjugate polymers are much promising for a cheap and flexible alternative to inorganic solar cells. Now a day's many solar cell technologies exist in which organic solar cells are one of the newer classes of these technologies. Since the discovery of photo induced charge transfer between organic donors and acceptors, a great effort has been devoted to explore these materials for photovoltaic applications fabrication, Street et. al (2011) & Cowan et. al (2012). Organic solar cells offer considerable promise for use in new solar energy technology due to their flexible material properties and low –cost manufacture, Liang. et. al., (2010). Solar cells based on a bulk heterojunction (BHJ) of conjugate polymers P3HT (poly 3-hexylthiophene) and PCBM (phynyl-C71 butyric acid methyl ester) have been reported among the highest performing material and have been considered as the largest in researchers investigation and studies, Rastogi et. al. (2013), for improving their power conversion efficiencies. Organic solar cell can be classified into the planar heterojunction devices, where donor and acceptor materials are deposited one after the other and bulk heterojunction (BHJ) solar cell in which two organic materials are mixed in the same solvent and spin-coated as one layer. Organic solar cell or polymer solar cell (PSC) based on bulk heterojunction (BHJ) composites of conjugate polymers P3HT: PCBM have shown rapid improvement in the past few Years, Heeger et. al. (2014). The photovoltaic performance of the combination of the P3HT and PCBM in organic blends has currently increased approaching 6.4 % energy conversion efficiency at thickness $25X10^{-7}$

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