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ABSTRACT

In this paper the effect of 5-(10-undecenyloxy)-2-[[[4-hexylphenyl]imino]methyl]phenol liquid crystal addition into Poly(3-hexylthiophene):Fullerene containing solar cells were investigated. Based on current-voltage characteristics, we report on the efficiency enhancement for bilayer heterojunction solar cells using this liquid crystal.

Keywords: Poly(3-hexylthiophene); Fullerene; Organic Photovoltaics, Solar Cells, Liquid Crystals; Power Conversion Efficiency.

1. INTRODUCTION

Organic photovoltaic (OPV) cells have currently been receiving considerable attention due to their high-mechanical flexibility and light weight [1–3]. Recently, several research groups have reported photo conversion efficiencies (PCE) around 10% [4–6]. OPV cells with a bilayer heterojunction structure have achieved power conversion efficiencies up to 5% [7, 8], which is still far from the efficiency required for practical mass applications. The prospect of applications of organic photovoltaic cells to enhance the PCE under simulated sunlight [9].

In organic solar cells, conjugated polymers containing thiophene rings, such as poly(3-hexylthiophene) (P3HT) play a role as electron donors in charge transport [9–11]. P3HT is a widely used organic semiconductor and therefore it is a possible candidate for application in polymer solar cells [12]. It shows good enviromental stability [13], proper field–effect mobility of 0.01 -0.1 cm^2/Vs, reasonably high hole mobility in the range of 10^{-3} cm^2/Vs [14], has an absorption edge around 1.9-2.0 eV [15] and has a high solubility.

The use of a Fullerene (C60) molecule sublimed onto the polymer in a heterojunction (bilayer) or mixed in the polymer film (bulk heterojunction blend) increased drastically the efficiency of photovoltaic devices [16-21]. The efficiency of OPV cells has been significantly