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Sources of high photo-current in inverted organic solar cells[1]
ABAY GADISA, Department of Chemistry and Astronomy, UNC- Chapel Hill, YINGCHI LIU, RENE LOPEZ, Department of Physics and Astronomy, UNC-Chapel Hill, EDWARD SAMULSKI, Department of Chemistry, UNC- Chapel Hill, SOLAR UNC TEAM — Inverted organic solar cells have been proved to render exceptional environmental stability compared to the conventional solar cell architecture. On the other hand, polymer/fullerene based inverted solar cells produce more photo-current compared to conventional cells comprising the same active layer thickness. The origin of this current has never been clearly stated so far. We have investigated the photovoltaic properties of inverted solar cells comprising a bulk heterojunction layer of poly(3-hexylthiophene) (P3HT) and phenyl-C61-butyric acid methyl ester (PCBM). The blend layer was formed by spin casting the blend solution on ITO substrate, covered with an Al doped zinc-oxide layer (ZnO-Al) deposited through pulsed laser deposition technique. The inverted solar cells show over 15% increase in photo-current yield compared to conventional solar cells. We have discovered that the inverted solar cells produce additional photo-current through dissociation of excited electron-hole pairs near the polymer/ZnO-Al interfaces. Since ZnO-Al is a good electron conductor, the electrons generated at the polymer/ZnO-Al interface are more efficiently collected compared to photo-current produced in the bulk of the active film. External quantum efficiency exceeding 70% was recorded in the ZnO-Al based inverted solar cells. In general, ZnO-Al is not only characterized by its high electron conductivity, and transparency but also serves as electron acceptor.

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