4th International Symposium on
Energy Challenges & Mechanics
- working on small scales

11-13 August 2015
Aberdeen, Scotland, UK

Bilayer Polymer Organic Photovoltaics with Non-planar Hetero Junction Prepared by Sequential Solution Processes

Jeesoo Seok1, Sungmin Park[2], Du Yeol Ryu[2], Kyungkon Kim[1*]

[1]*Department of Chemistry and Nano Science, Ewha Womans University, Seoul 120-750, Korea*
[2]*Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul 120-749, Republic of Korea*

Accepted for publication on 5th March 2015

An efficient polymer/fullerene bilayer organic photovoltaic (BL-OPV) device was developed via sequential soluton deposition (SqSD) process. Two essential problems regarding the construction of an efficient SqSD processed BL-OPV were resolved. First, the constructing bilayer by the SqSD process was resolved by incorporating an ordering agent (OA) to the polymer (bottom-layer) solution, which improved the ordering of the polymer chain and prevented the bottom-layer from dissolving by the fullerene (top-layer) solution. Second, a non-planar heterojunction with a large surface area was formed by the incorporation of a heterojunction agent (HA) to the top-layer solution. Several polymers including P3HT, PCDTBT and PTB7 were used for the bottom-layer and phenyl-C_{71}-butyric-acid-methyl ester ($PC_{70}BM$) was used for the top-layer. The SqSD processed PCDTBT/$PC_{70}BM$ BL-OPV produced utilizing both an OA and HA exhibited a power conversion efficiency (PCE) of 7.12% with a high internal quantum efficiency (IQE). We believe our bilayer system affords a new way of forming OPVs distinct from the system prepared by the one step solution deposition (SD) process that utilizes a mixed solution of polymer and fullerene, and offers a chance to reconsider the polymers that have thus far shown unsatisfactory performance by the one step SD process.

Keywords: Organic solar cell, Organic photovoltaics, Bilayer solar cell, Sequential solution deposition process