IT-006

Small Molecular Solar Cells toward Improved Efficiency and Stability

김지환, 김효정, 정원익, 김태민, 이영은, 김세용, 김장주

Department of Materials Scienc and Engineering, Seoul National University

We will report a few methods to improve the efficiency and stability in small molecule based organic solar cells, including the formation of bulk heterojunctions (BHJs) through alternative thermal deposition (ATD), the use of a micro-cavity structure and interface modifications. By ATD which is a simple modification of conventional thermal evaporation, the thicknesses of alternative donor and acceptor layers were precisely controlled down to 0.1 nm, which is critical to form BHJs. The formation of a BHJ in copper(II) phthalocyanine (CuPc) and fullerene (C60) systems was confirmed by AFM, GISAXS and absorption measurements. From analysis of the data, we found that the CuPc|C60 films fabricated by ATD were composed of the nanometer sized disk shaped CuPc nano grains and aggregated C60, which explains the phase separation of CuPc and C60. On the other hand, the co-deposited CuPc:C60 films did not show the existence of separated CuPc nano grains in the CuPc:C60 matrix. The OPV cells fabricated using the ATD method showed significantly enhanced power conversion efficiency compared to the co-deposited OPV cells under a same composition [1]. We will also present by numerical simulation that adoption of microcavity structure in the planar heterojunction can improve the short circuit current in single and tandem OSCs [2]. Interface modifications also allowed us to achieve high efficiency and high stability OSCs.

Keywords: small molecule, organic solar cell, bulk heterojunction, alternative deposition, microcavity, interface modification

References

[1] Ji Whan Kim, Hyo Jung Kim, Hyun Hwi Lee, Taemin Kim, and Jang-Joo Kim, Advanced Functional Materials (in print)

[2] Jane Lee, Sei-Yong Kim, Changsoon Kim, and Jang-Joo Kim, Appl. Phys. Lett. 97, 083306, 2010