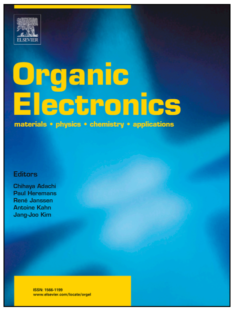
Accepted Manuscript



Effect of the charge balance on high-efficiency inverted polymer light-emitting diodes

Qingyu Huang, Suling Zhao, L. Jay Guo, Zheng Xu, Peng Wang, Zilun Qin

PII: S1566-1199(17)30225-2

DOI: 10.1016/j.orgel.2017.05.028

Reference: ORGELE 4099

To appear in: *Organic Electronics*

Received Date: 5 March 2017

Revised Date: 22 April 2017

Accepted Date: 14 May 2017

Effect of the charge balance on high-efficiency inverted polymer light-emitting diodes

Qingyu Huang[1,2], Suling Zhao[1*], L. Jay Guo[2], Zheng Xu[1], Peng Wang[1] , Zilun Qin[1]
[1]*Key Laboratory of Luminescence and Optical Information (Beijing Jiaotong University), Ministry of Education, Beijing 100044, China;*
[2]*Department of Electrical Engineering and Computer Science, University of Michigan-Ann Arbor, MI, 48105, USA*

In this work, an ultra-thin insulating layer, poly(methylmethacrylate) (PMMA), is incorporated between the emissive layer (EML) and hole transporting layer (HTL) within the inverted polymer light-emitting diodes (PLEDs). Such a structure helps to reduce the hole injection and balance the electrons and holes in the EML. PLEDs with optimal PMMA thickness of around 5.6 nm is observed to obtain a maximum current efficiency of 14.33 cd A^{-1}, which corresponds to 7.07% improvement compared to that of the device without PMMA layer (13.5 cd A^{-1}). The device with best performance exhibits a superior low driving voltage of 2.5 V at 1 cd m^{-2} and shows a lower efficiency roll-off current efficiency which sustains 85% of the maximum value when the current density reaches 140 mA cm^{-2}.

Research in the use of organic polymers as the active semiconductors in light-emitting diodes has advanced rapidly. Solution-processed polymer light-emitting diodes (PLEDs) are promising for large area displays and general lighting sources owing to the compatibility with lightweight, flexible substrates and the potential for low-cost fabrication[1]. In many cases, however, solution deposition of high-quality films without intermixing is ruled by solvent limitations and incapable for stacking an arbitrary number of functional layers. One effective approach for this challenge is inverted PLEDs which comprise organic polymers and solution-processible semiconductor metal oxides such as titanium oxides[2, 3], zirconium dioxide[2], and zinc oxide[4]. These n-type metal oxides are air-stable, solution-processability at

[*] Corresponding author: Suling Zhao, slzhao@bjtu.edu.cn, 010-51684462