Electrospun Zno Nanowire Plantations In The Electron Transport Layer For High-Efficiency Inverted Organic Solar Cells

Naveen Kumar Elumalai,Tan Mein Jin,Vijila Chellappan, Rajan Jose, Suresh Kumar Palaniswamy, Sundaramurthy Jayaraman, Hemant Kumar Raut, and Seeram Ramakrishna

National University of Singapore, Singapore 117576
Institute of Materials Research and Engineering (IMRE), Agency for Science, Technology and Research (A STAR), 3 ResearchLink, Singapore 117602
⊥Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Pahang, Malaysia
Environmental & Water Technology, Centre of Innovation, Ngee Ann Polytechnic, Singapore
Center for Nano fibers and Nanotechnology, National University of Singapore, Singapore

Abstract

Inverted bulk heterojunction organic solar cells having device structure ITO/ZnO/poly(3-hexylthiophene) (P3HT):[6,6]-phenyl C61 butyric acid methyl ester (PCBM)/MoO_3/Ag were fabricated with high photoelectric conversion efficiency and stability. Three types of devices were developed with varying electron transporting layer (ETL) ZnO architecture. The ETL in the first type was a sol−gel-derived particulate film of ZnO, which in the second and third type contained additional ZnO nanowires of varying concentrations. The length of the ZnO nanowires, which were developed by the electrospinning technique, extended up to the bulk of the photoactive layer in the device. The devices those employed a higher loading of ZnO nanowires showed 20% higher photoelectric conversion efficiency (PCE), which mainly resulted from an enhancement in its fill factor (FF). Charge transport characteristic of the device were studied by transient photovoltage decay and charge extraction by linearly increasing voltage techniques. Results show that higher PCE and FF in the devices employed ZnO nanowire plantations resulted from improved charge collection efficiency and reduced recombination rate.

Keywords : Renewable energy materials, charge transport layers, inverted polymer solar cells, heirarchical structures, carrier lifetime, electrospinning

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