

Influence of Recombination of Free and Trapped Charge Carriers on the Efficiency of Conventional and Inverted Organic Solar Cells

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Abstract : Organic solar cells (OSCs) have been actively investigated in the last two decades due to their several merits such as simple fabrication process, low-cost manufacturing, and lightweight. In this paper, using the optical transfer matrix method (OTMM) and solving the drift-diffusion equations processes of recombination are studied in inverted and conventional bulk heterojunction (BHJ) OSCs. Two types of recombination processes are investigated: 1) recombination of free charge carriers using the Langevin theory and 2) of trapped charge carriers in the tail states with exponential energy distribution. These recombination processes are incorporated in simulating the current- voltage characteristics of both conventional and inverted BHJ OSCs. The results of this simulation produces a higher power conversion efficiency in the inverted structure in comparison with conventional structure, which agrees well with the experimental results.

Keywords : conventional organic solar cells, exponential tail state recombination, inverted organic solar cells, Langevin recombination

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