Classical or inverted photovoltaic cells: On the importance of the morphology of the organic layers on their power conversion efficiency

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Mots-clés	Classical organic solar cells; Inverted organic solar cells; Thin film morphology; Atomic force microscopy; Thiophene derivatives [13]
Résumé en anglais	Novel organic thiophene derivatives, (E)-Bis-1,2-(5,500-Dimethyl-(2,20:30,200-terthiophene)vinylene (BSTV) and (E)-Bis-1,2-(5,500-Dimethyl-(2,20:30,200:30,2000-tetrathiophene)vinylene (BOTV), with different numbers of thiophene units, have been synthesized. They are introduced into organic photovoltaic cells as electron donor. The both organic photovoltaic cell configurations are probed: classical, i.e. with the ITO used as anode, and inverted, i.e. with ITO used as cathode. Whatever the cell configuration, the best results are obtained when a double cathode buffer layer Alq3/Ca is used. Actually, such double cathode buffer layer allows cumulating the advantages of its both constituents. The Alq3 blocks the excitons and protects the organic electron acceptor from cathode diffusion during its deposition, while the low work function of Ca induces a good band matching at the interface electron acceptor/cathode. On the other hand, it is shown that the organic layer surface morphology is decisive whatever the cell efficiency. While the BSTV layers are homogeneous those of BOTV are not. It follows that, in the case of classical organic photovoltaic cells, leakage currents limits the performances of the cells using BOTV, and better performances are obtained with BSTV. This difficulty is overcome in the case of inverted organic photovoltaic cells. This configuration allows limiting the effect of the inhomogeneities of the donor layer and better efficiencies are obtained with BOTV, which was expected due to its smaller band gap value.

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