On the influence of the exciton-blocking layer on the organic multilayer cells properties

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Résumé en anglais	The performances of organic photovoltaic cells based on the layer couple electron donor/electron acceptor (ED/EA) are significantly improved when an exciton blocking layer (EBL) is inserted between the organic acceptor and the cathode. A new material, the (Z)-5-(4-chlorobenzylidene)-3-(2-ethoxyphenyl)-2-thioxothiazolidin-4-one, that we called (CBBTZ), has been synthesized, characterized and probed as EBL. The energy levels corresponding to the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) of the CBBTZ have been determined from the first oxidation and reduction potential respectively, using cyclic voltametric (CV) measurements. From CV curves, CBBTZ in dichloromethane showed a one electron reversible reduction and oxidation waves. The values of its HOMO and LUMO have been estimated to be 6.42 eV and 3.42 eV respectively. Such values show that CBBTZ could be probed as EBL in organic solar cells based on the ED/EA couple copper phthalocyanine(CuPc)/fullerene (C60). The photovoltaic solar cells have been obtained by sequential deposition under vacuum of the different films. The different thin film thicknesses were measured in situ by a quartz monitor. Multilayer solar cells ITO/Au/CuPc/C60/EBL/Al have been probed, where EBL is the aluminium tris(8-hydroxyquinoline) (Alq3), the CBBTZ, the 2-(4-byphenylyl)-5-(4-tert-buthylphenyl)-1,3,4-oxadiazole (butyl PBD) or the bathocuproine (BCP). The optimum film thickness is 8–9 nm whatever the EBL used. When obtained in the same run, the averaged efficiency of the cells using the CBBTZ is of the same order of magnitude than that obtained with BCP and higher than that achieved with Alq3 or butyl PBD. It is shown by XPS study that some aluminium of the cathode is present in the buffer layer. This aluminium could justify the ability of the electrons to cross the insulating exciton blocking layer thick of 9 nm.

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