EFFECT OF MOLECULAR WEIGHT ON THE PHOTOVOLTAIC PERFORMANCE OF A LOW BAND GAP COPOLYMER BLENDED WITH ICBA

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INTRODUCTION.

In this work we fabricated solar cells by combining ICBA as electron acceptor material with various weight fractions of a low band gap electron donor copolymer based on 2,1,3-benzothiadiazole, thiophene and thieno[3,2-b]thiophene units (labeled PPBzT^2-CEHb), whose structure is given in Fig. 1 [1]. We investigated the influence of the polymer molecular weight and post-deposition annealing temperature on the solar device performances. Charge transport in pristine polymer films was also studied by measuring the field-effect hole mobility in bottom contact field-effect transistors (OFET).

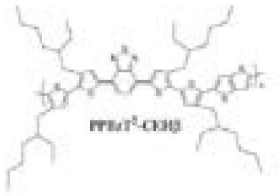

Figure 1. *Molecular structure of PPBzT2-CEHβ*

EXPERIMENTAL PART.

New low band gap copolymer based on 2,1,3-benzothiadiazole, thiophene and thieno[3,2-b]thiophene units was studied in organic solar cells with indene-C60-bis-adduct (ICBA). The copolymer molecular weight ranged from 10 kg/mol to 45 kg/mol. Bottom-contact field-effect transistors were elaborated with pristine copolymer to estimate the hole mobility.

RESULTS AND DISCUSSION.

Mainly due to high lying LUMO level of ICBA, we gained in open circuit voltage (0.83 V) of solar cells. In all case annealing enhanced the overall performance of the solar cells. As for the highest molecular weight copolymer, due to its disordered morphology and poor homogeneity of the films the highest recorded PCE lied around 1%. Hole mobility in bottom contact devices increased with increasing the molecular weight of the copolymer.

CONCLUSIONS.

We showed that using the ICBA fullerene derivative as electron-acceptor, increases significantly the open-circuit voltage of the device (in comparison with devices based on PCBM [1]). Furthermore, charge carrier mobility tends to improve with the molecular weight of the recently developed low band gap copolymer. Finally, a power conversion efficiency of 2.4% with an open circuit voltage of 0.83 V was reached in a standard device configuration with aluminum as a cathode after post-deposition thermal annealing.

REFERENCES.

1. L. Biniek, S. Fall, C. L. Chochos, N. Leclerc, P. Leveque, T. Heiser. (2012). Optimization of the side-chain density to improve the charge transport and photovoltaic performances of a low band gap copolymer. Org. Elec., 13: 114-120.