Photophysical Study of Polymer-Based Solar Cells with an Organo-Boron Molecule in the Active Layer

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Abstract.

Our group previously reported the synthesis of four polythiophene derivatives (P1–P4) used for solar cells. The cells were prepared under room conditions by spin coating, leading to low efficiencies. However, after the addition of 6-nitro-3-(E)-3-(4-dimethylaminophenyl)allylidene)-2,3-dihydrobenzo[d]-[1,3,2] oxazaborole (M1) to their active layers, the efficiencies of the cells showed approximately a two-fold improvement. In this paper, we study this enhancement mechanism by performing ultrafast transient absorption (TA) experiments on the active layer of the different cells. Our samples consisted of thin films of a mixture of PC61BM with the polythiophenes derivatives P1–P4. We prepared two versions of each sample, one including the molecule M1 and another without it. The TA data suggests that the efficiency improvement after addition of M1 is due not only to an extended absorption spectrum towards the infrared region causing a larger population of excitons but also to the possible creation of additional channels for transport of excitons and/or electrons to the PC61BM interface.