ANALYTICAL AND EXPERIMENTAL ANALYSIS OF RECOMBINATION MECHANISMS IN BULK HETEROJUNCTION SOLAR CELLS

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Bulk Heterojunction organic solar cells (OPVs) are devices based on blends of conducting polymers and fullerene derivatives. One of the big challenges to pushing these devices toward the market is the low efficiency achieved by them. The main cause of this problem is the non-geminative (bimolecular) recombination. To study this effect in OPVs, we used an analytical photocurrent model, recently developed by Amorim and Faria. The model assumes that the carriers recombination mechanism is mathematically described by second order kinetics and the electron and hole mobilities have similar order of magnitude. To do this study, BHJ devices were manufactured. We use the J-V measurement technique, in the dark and under illumination. Measurements of transient photovoltage (POS), photocurrent transient (TPC), and Photo-CELIV (Charge Extraction Linear Increasing Voltage) were also performed. All of these measurements were performed in different levels of light intensity and at different temperatures. The Amorim and Faria model uses an equation that is capable of fitting experimental curves of photocurrent. Their model makes it possible to extract intrinsic parameters of the charge carrier transport, such as mobility and recombination coefficient which, in turn allow to analyze the effects of these parameters on the JV curve. The model is very relevant for studying the performance of the device as well as for the comprehension of the recombination mechanisms that is still a debated topic on the literature.