Chasing Charge Transfer States in DBP:C70 Organic solar Cells

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Abstract

Organic solar cells (OSC) are promising devices within the area of green energy technology, which can be fabricated from organic compounds with cheep techniques and on flexible or transparent substrates such as plastic or glass. OSCs are cost efficient, and lightweight devices that can exhibit high power conversion efficiencies (PCE) under low light irradiation. These advantages have made OSCs of great interest in research communities, where they have been extensively studied over the course of the past few years[1]. Despite these advantages, OSCs still exhibit low stability and lifetimes, which puts a barrier between laboratory achievements and industrial scale requirements. Therefore, in order to close this gap and obtain further improvements in device performance and long-term outdoor stability, a detailed understanding of the device degradation mechanism is required.
In an OSC, effective dissociation of the excitons takes place at the donor-acceptor interface via delocalized charge-transfer (CT) states, which represents intermediate states between the exciton dissociation and generation of free charges (or recombination back to the ground state). In this work, we investigate both electroluminescence (EL) created by bimolecular recombination via interface charge transfer states as well as sensitive external quantum efficiency measurements (sEQE) in DBP:C70 based OSCs, in order to study the role of CT states on degradation of the OSC devices[2]. The results from these measurements reveal valuable information about the loss mechanisms during OSC aging by considering the energetic and photo-physical behavior of the CT states, which also will set the base for further device modeling[3] and optimizing of the stability of the organic solar cells.

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