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Origin and impact of recombination via charge transfer excitons in polymer/fullerene solar cells MARKUS HALLERMANN, ENRICO DA COMO, JOCHEN FELDMANN, Photonics and Optoelectronics Group, LMU Munich — To further advance the performances of organic photovoltaic cells a thorough understanding of loss mechanisms in polymer/fullerene blends is mandatory. Recombination via charge transfer excitons (CTEs) appears to be a fundamental loss, potentially impacting the open circuit voltage (V_{OC}) and the short circuit current (I_{SC}) of cells. We unravel the origin of CTEs forming in polymer/fullerene blends and discuss their importance in recombination processes considering binding energy [1], polymer conformation [2], and energetic position. CTE photoluminescence (PL) is observed in material combinations such as P3HT and PPV blended with fullerene acceptors. By combining electron microscopy and PL spectroscopy, we show that CTE recombination is only slightly influenced by the mesoscopic morphology, whereas strongly by the polymer chain conformation [2]. By shifting the orbital energies of the fullerene, we tune the CTE PL characteristics. High energy CTE emission results in cells with a beneficial increase in V_{OC}. On the other hand, high energy CTE emission leads to a more efficient recombination impacting directly the I_{SC}. The results highlight a fundamental limit in the efficiency of organic solar cells with CTE recombination. [1] Hallermann et al. APL 2008 [2] Hallermann et al. AFM 2009

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