Multi-junction solar cells from DBP/C70 reaching open-circuit voltages of 6.44 V

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Abstract

In this work, we have investigated a simple multi-junction method for achieving high Voc in organic solar cells by stacking individual sub-cells on top of each other. The promising Tetraphenyldibenzoperiflanthen (DBP) was employed as electron donor and Fullerene (C70) was employed as electron acceptor, as they display a relatively high Voc for single junction cells. Both materials show broad absorption in the visible region, making them ideal candidate for multi-junction devices, using these molecules as active materials having a recombination layer in between each sub-cell. By using a 10-Fold bilayer structure of DBP and C70, sandwiched between two electrodes, a very high open circuit voltage of 6.44 V was reached for a single device stack with a current density of 0,68mA/cm2 and a power conversion efficiency of around 2%. To further optimize the devices towards higher efficiency, we have modeled the performance of each sub-cell, and from that established the ideal thicknesses required to obtain charge carrier balance in the devices stack. The work shows a promising method for generating high voltage device stacks from small molecule solar cells.

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