DBP Organic Small Molecule as Hole Transport Layer in Perovskite based Photovoltaics

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Abstract

Perovskite Solar Cells have recently attracting a lot of attention mainly due to their high power conversion efficiencies, which exceeds that of pure organic solar cells. In order to optimize the devices further, we here investigate the use of the electron donating organic semiconductor Tetraphenyldibenzoperiflanthen (DBP), which is typically used as a P-type active layer in pure organic solar cells due to its high absorption coefficient and hole mobility. The property that makes DBP an ideal hole transport layer for mixed Perovskite solar cells lies on its energy band-diagram alignment to transport holes to the anode. In contrast to its low electron mobility, DBP shows promising results for hole extraction when fabricated at specific thicknesses and temperatures, which is due to its relatively high mobility for holes. The combination of DBP/MoO3 layer as hole transport layer further increases charge extraction of holes at the interface of DBP and MoO3, and the improved recombination of electrons and holes at this interface increase the current production in the devices. In this work, we demonstrate that optimization of the DBP and MoO3 layers, especially in terms of layer thicknesses, has a strong impact on the devices performances, as characterized under standard 1 Sun conditions. The work has potential for improving further the device performance of Perovskite based devices.

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