ABSTRACT

In this paper, the mechanisms of charge generation and recombination in single-component solar cells based on donor-acceptor star-shaped oligomer N(Ph-2T-DCV-Et)$_3$ are experimentally determined.

Single-component organic solar cells based on N(Ph-2T-DCV-Et)$_3$ exhibits the power conversion efficiency of 1.13% and the maximum external quantum efficiency of 24%. These results are among the highest published efficiencies for single-component solar cells based on conjugated molecules. These solar cells show small energy losses, resulting in the very high open-circuit voltage of 1.19 V. From measurement of the current-voltage characteristics under different light intensities we show that monomolecular recombination dominates from the short-circuit condition to the maximum power point, but after the maximum power point and up to the open-circuit condition bimolecular recombination dominates.

The results indicate the prospects for further studies of organic single-component solar cells based on conjugated donor-acceptor molecules.