More from Less: High efficiency organic solar cells with simple active layers

Shaun McAnally[1], Paul Shaw[1] and Paul Burn[1]

[1]Centre for Organic Photonics & Electronics (COPE), School of Chemistry and Molecular Biosciences, The University of Queensland, Queensland, 4072, Australia
s.mcanally@uq.edu.au

The advent of efficient non-fullerene small molecule acceptor (NFA) materials for organic photovoltaic (OPV) devices has led to a series of breakthroughs in performance and device lifetime. The most efficient OPV devices have a combination of electron donor and acceptor materials that constitute the light absorbing layer as either a bulk heterojunction (BHJ) or in a sequentially deposited bilayer structure. For many BHJ-based devices used to date, the weight ratio of donor to acceptor is near equal. In a BHJ, this equal weight ratio is seen as a way of ensuring the formation of a continuous interpenetrating network of donor and acceptor molecules to facilitate the efficient dissociation of excitons and subsequent charge transport and extraction. However, the morphology of such films can often be difficult to reproduce and manufacture at scale. The ability to fabricate OPV devices with reduced quantities of one of the materials, e.g., the donor, while maintaining photovoltaic performance, is a potential pathway towards attaining greater control over the bulk morphology of the active layer and, by extension, more consistent large-area device manufacturing. In this contribution, we present an investigation into the effect of having low donor content in NFA-based BHJ films and how this affects the performance of OPV devices containing them. We report the photophysical, charge mobility and device properties of the low donor content films.