Exploiting the potential of 2-((5-(4-(diphenylamino)phenyl)thiophen-2-yl)methylene)malononitrile as an efficient donor molecule in vacuum-processed bulk-heterojunction organic solar cells

Titre	Exploiting the potential of 2-((5-(4-(diphenylamino)phenyl)thiophen-2-yl)methylene)malononitrile as an efficient donor molecule in vacuum-processed bulk-heterojunction organic solar cells
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Résumé en anglais	A comprehensive experimental study is reported on the optical and electrical characteristics of 2-((5-(4-(diphenylamino)phenyl)thiophen-2-yl)methylene)malononitrile (DPTMM) when used as molecular donor in an organic solar cell (OSC) device structure. A major property of this new donor-type material is an unusually deep highest-occupied molecular orbital (HOMO) level that leads to a high open-circuit voltage (Voc). A reasonably high hole-mobility was also observed in a hole-injection diode configuration. These are both promising factors for high-performance OSCs. In order to fully explore the potential of DPTMM in bulk-heterojunction-based OSCs, a step-wise experimental strategy was applied to optimize film composition and cell architecture. By co-evaporating the DPTMM with C60 to promote exciton dissociation by maximizing the heterojunction area power conversion efficiency (PCE) of 3.0% was achieved. Finally, inserting a buffer layer and a spatial gradient of the donor/acceptor ratio was found to provide better conduction paths for charge carriers. The maximum obtained PCE was 4.0%, which compares favorably with the state-of-the-art of high-performance OSCs. All optimized devices show quite unusual high Voc values up to 1 V.
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