Design and Synthesis of Novel Polymer Donor Materials for Highly Efficient Organic Solar Cells

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Organic bulk heterojunction (BHJ) solar cells comprising conjugated polymers and fullerene derivatives have recently attracted attention due to their lightweight, low cost, the potential for the fabrication of large-area flexible devices.[1] In the past few years, extensive effort has focused on developing donor-acceptor (D-A) conjugated polymers, leading to steady increases in power conversion efficiencies (PCEs). Recently, PCEs over 10% have been reported for organic solar cells.[2,3] In terms of the development of D-A conjugated polymers, the emphasis has been on moderate-bandgap (MBG, optical band gap, E_g^{opt}: 1.6-1.8 eV) and low-bandgap (LBG, E_g^{opt}< 1.6 eV) copolymers. However, the design and synthesis of high performance wide-bandgap (WBG) polymers (Eg > 1.8 eV) still remains a challenge. Solar cells based on WBG polymers tend to have high open-circuit voltage, but relatively low short-circuit current, resulting in moderate PCEs.

Here, we developed several high-performance WBG polymers. When they blended with $PC_{70}BM$, high power conversion efficiencies close to 10% have been achieved.[4] Moreover, high-performance organic ternary blend solar cells and non-fullerene solar cells were also fabricated using these WBG polymers.[5,6]

References

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