High Performance Ternary Organic Solar Cells

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Significant progress has been achieved recently in the production of bulk heterojunction organic solar cells (OSCs) based on binary active layer composed of donor–acceptor (D-A)-type polymers or small molecules as donors and fullerene derivatives (e.g. PCBM) as acceptor.[1,2] Compared with binary OSCs, ternary systems containing two donors and one acceptor (or one donor and two acceptors) can broaden the absorption range of active layers through complementary absorption of two donors, thereby providing a potentially effective route in achieving high Jsc and thus high efficiency. In this presentation, a ternary OSC is designed and fabricated, which contains a D–A-type polymer and a high-crystaline small molecule as donors and fullerene derivatives as acceptor. The small molecules increase the crystallinity of the donor phase, whereas the ratios of small molecules to polymers can tune the domain size of the ternary system. The PCE of the ternary OSCs is higher than that of binary systems based on small molecules or polymers.[3] By a further optimization of the ternary system, a PCE of 10.5% was obtained, which is among the highest values for OSCs.[4] A hierarchical alloy model is proposed to explain the working mechanism of ternary system, which may lead to a further improvement of the performance of the organic solar cells.

References

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