Non-Fused Ring Electron Acceptors for Sustainable and Low-cost Optoelectronics

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In recent years, the development of non-fullerene acceptors (NFAs) with ladder-type multiple fused ring structures has led to rapid advances in organic optoelectronic devices. However, the complex molecular architectures of fused ring electron acceptors require numerous synthetic and purification steps and hazardous substances, hindering large-scale synthesis and sustainability. Non-fused ring electron acceptors (NFREAs), on the other hand, offer several advantages such as simplified synthesis, facile chemical modifications, and straightforward tunability of optoelectronic properties. This talk will showcase A-π-A'-π-A structured NFREAs newly developed in our lab, their use in binary and ternary blend organic solar cells (OSCs)[1-2] and organic photodetector,[3] and how engineering of central core unit, alkyl chain, and terminal group influence device performance. The ambipolar NFREA,[4] alloy-like NFREA,[5] halogenation strategy in NFREA,[6] and their influence on ternary blend OSCs will be explained. Finally, I will discuss the synthesis complexity, cost analysis and figure-of-merit (FOM) values of NFREAs compared to traditional fused-ring type NFAs and explore the challenges and future directions of NFREAs for achieving high device performance and low production costs simultaneously.

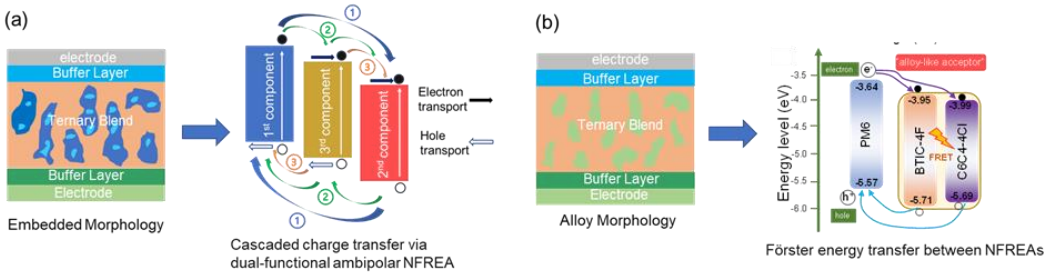

Figure 1. The ambipolar NFREA (a) and alloy-like NFREA (b) in ternary blend OSCs

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