ORGANIC PHOTOVOLTAICS

Design tweaks

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In recent years, non-fullerene acceptors (NFAs) have opened up a new research area in organic solar cells as they offer more flexibility in terms of chemical structure than the archetypal fullerene derivatives. In particular, the fine alignment of the energy levels of NFAs to that of the polymer donors and the broadening of the absorbance across the visible–near-infrared region have enabled power-conversion efficiency over 15%. Devising new molecular structures is therefore critical to unlock performance improvements in these devices. Now, Yingping Zou and colleagues in China, Canada and Poland report on a low-bandgap NFA with a charge-deficient core that leads to device efficiency up to 15.7%.

The researchers synthesize a ladder-type fused-ring central unit with a benzothiadiazole-based core that acts as an electron-deficient moiety. Such a design results in an enhanced electron affinity and a narrow energy bandgap of 1.33 eV. Functional groups and side alkyl chains are selected to improve solubility, further extend the absorption, and enhance molecular interactions to facilitate charge transport. By using a commercial polymer donor, the researchers investigate the photovoltaic performance of the optimized NFA, fabricating an organic solar cell. The device delivers efficiencies up to 15.7% in both the conventional and inverted device configurations. These results suggest that fused-ring NFAs with an electron-deficient core hold great potential for organic solar cells.

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