Synthesis of Conjugated Donor-Acceptor Antiaromatic Porphyrin and Their Application to Perovskite Solar Cells

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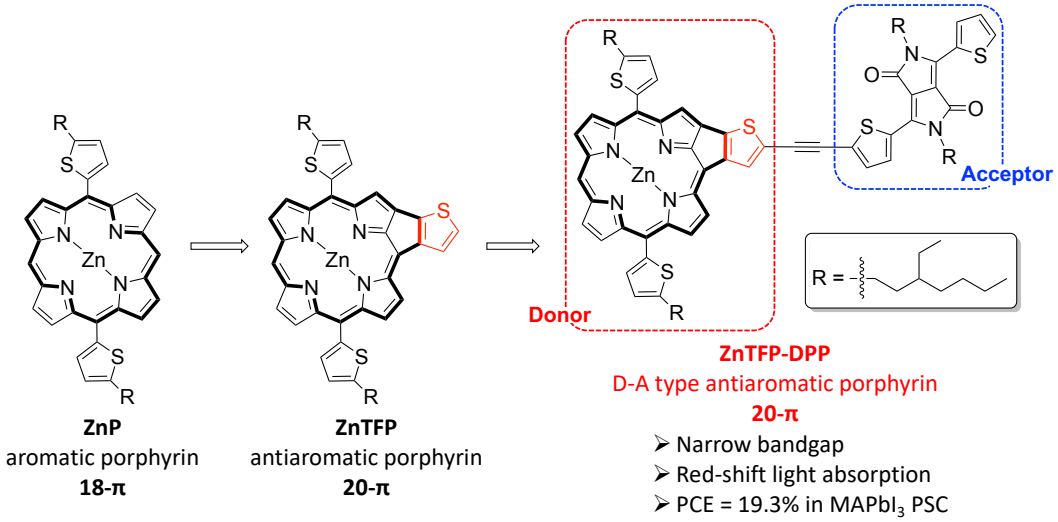

Porphyrins, one of the most abundant macrocyclic structures in natural products, have been widely studied owing to their intrinsic aromaticity arising from their cyclic coplanar 18-π electron system. Compared with aromatic porphyrins, antiaromatic porphyrins have a narrow bandgap with significant red-shifted absorption to near-infrared (NIR) range, which would be rational to apply in photovoltaics for enhancing light absorption. Surprisingly, however, there have been hardly any studies focusing on photovoltaic applications of antiaromatic porphyrins compared with classical aromatic porphyrins. In this work we aimed to demonstrate a prototype study using conjugated antiaromatic donor-acceptor (D-A) type porphyrin (**ZnTFP-DPP**) in PSCs. The synthesized antiaromatic porphyrin contains a thieno-fused zinc porphyrin (ZnTFP) and a diketopyrrolopyrrole (DPP) moiety. It should be noted that DPP unit, an excellent chromophore that have been widely applied in a D-A type molecule, also shows superior compatibility in the antiaromatic porphyrin. **ZnTFP-DPP** was applied as a light-absorbing dopant in PSCs for performance enhancement, which exhibited a highest power conversion efficiency (PCE) of 19.3% with the enhancements in both V_{OC} and short-circuit current (J_{SC}). With these results, this study not only contributes to the fundamental understanding of antiaromatic porphyrins, but also paves the way for the development of antiaromatic photovoltaic materials.