Synthesis and characteristics of pyrrolo[3,2-b]pyrrole-2,5-dione for small molecules for organic polymer solar cells

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Organic photovoltaics (OPVs) have much potentials to be renewable and cost-effective energy sources due to their significant advantages including favorable solution processability, and low-cost manufacturing, such as ink-jet printing, brush painting and roll-to-roll process.
A new n-type accepter unit, pyrrolo[3,2-b]pyrrole-2,5-dione, has much advantages as the electron-deficient unit for the generation of electron donor material for organic photovoltaic cells (OPVs).
Pyrrolo-[3,2-b]pyrrole-2,5-dione unit, regioisomer of the known pyrrolo[3,4-c]pyrrole-1,4-dione, is originated from the structure of stable synthetic pigment. The organic low band gap molecules with pyrrolo-[3,2-b]pyrrole-2,5-dione, thiophene and triphenyl amine units were synthesized using Suzuki polymerization to generate SM-B, SM-M and SM-H. The spectrum of SM-B as the solid thin film shows absorption band with maximum peaks at 356 nm and 517 nm, and the absorption onset at 667 nm, corresponding to band gap of 1.86 eV. The device comprising SM-B and $PC_{71}BM$ (1:4) showed a V_{OC} of 0.79 V, a J_{SC} of 6.04 mA/cm^2, and a FF of 0.33, giving a power conversion efficiency of 1.56%.

References

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