New organic semiconducting material for solution-processed small molecule organic solar cells

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The organic materials have electron-donor and -acceptor moieties to the effective electron delocalization through the π-conjugation length. Spirobifluorene-based molecules have rigid fused ring structure which efficiently suppresses intermolecular interactions to diminish aggregation of molecules owing to high steric hindrance. The spiro-linkages are particularly effective to suppress the excimer formation that is frequently happened in the solid thin film state of organic materials. In this work, a novel spirobifluorene-based molecule, RTh-Sp-CF3 was synthesized and utilised for organic solar cells. The RTh-Sp-CF3 displays good solubility in common organic solvents owing to presence of terminal side chain. The RTh-Sp-CF3 displayed a reasonable HOMO and LUMO energy levels of −5.35 eV and −3.92 eV, respectively. SMOSCs fabricated with RTh-Sp-CF3 accomplished an overall power conversion efficiency (PCE) of ~2.12 % with short circuit current (JSC) of ~8.42 mA/cm2and the open-circuit voltage (VOC) of ~0.66 V. The smoother film morphology of devices might be due to better solubility facilitated the intramolecular charge transfer and enhances the performance.