NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
School of Electrical and Electronic Engineering

COEB PHOTONICS
COEB - Centre for OptoElectronics and Biophotonics

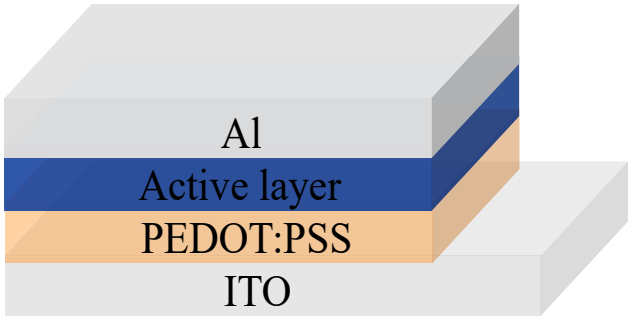
Enhanced Performance of The Organic Solar Cells Using A Newly Synthesized Polymer Donor

Abstract

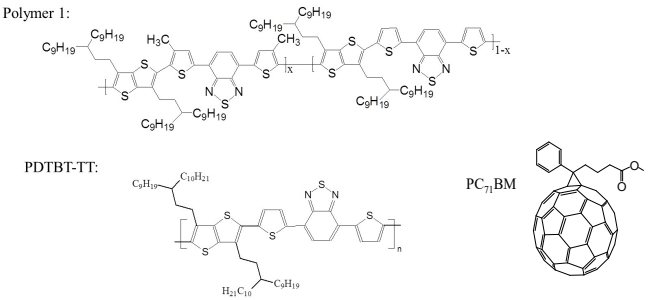
Current photovoltaic technology is mainly based on inorganic materials. Despite high efficiency of inorganic solar cells, high material and manufacturing costs are their limitations.

We previously reported a low bandgap polymer, PDTBT-TT[1]. We found that OSCs based on higher M_n PDTBT-TT had higher PCE of 6.71% but the solubility of PDTBT-TT in o-dichlorobenzene decreased with increasing M_n thus leading to rougher active layer surface and higher series resistance. To overcome this problem, we further modified the chemical structure of PDTBT-TT to get a new copolymer, polymer 1. Polymer 1 and PDTBT-TT have similar M_n but polymer 1 has higher solubility because of larger dihedral angles. After applying polymer 1 into OSCs, the highest PCE of 7.45% was obtained from the optimized device. The open circuit voltage (V_{oc}) of OSCs based on polymer 1 was 0.81 V higher than the V_{oc} of OSCs based on PDTBT-TT which was only 0.70 V.

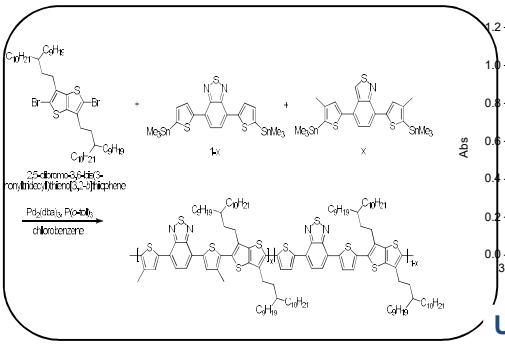
Device Structure

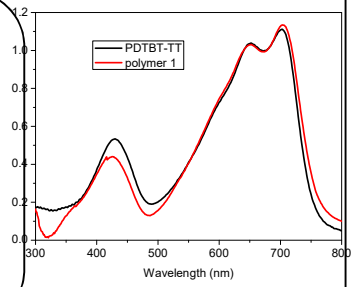


Molecular Structure of The Polymer



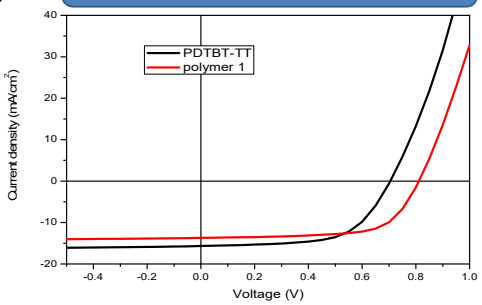
Structure and Synthesis of polymer 1





UV-vis absorption spectra

J-V Characteristics



Polymer	J_{SC} [mA/cm²]	V_{OC} [V]	FF [%]	PCE [%]
PDTBT-TT	15.65	0.70	61.31	6.76
Polymer 1	13.70	0.81	67.06	7.45

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