Organic tandem solar cells based on solution-processed small molecule photovoltaic cells

Hyunwoo Lee[1], Hoyeon Kim[1], Donggeun Han[1], Jaewon Ha[1], and Seunghyup Yoo[1]

[1]Dept. of Electrical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon 305-701, Korea

Tel.:82-42-350-3483, E-mail: syoo@ee.kaist.ac.kr

Organic solar cells have attracted a considerable attention as a renewable and alternative energy source because of their characteristics such as low cost, flexibility, semitransparency. However, the device performance is often limited by narrow absorption range, low carrier mobility, and short exciton diffusion length. To overcome this problem, tandem structure can be useful. In this work, optimized tandem solar cells using P3HT:$IC_{60}BA$ and p-DTS$(FBTTh_2)_2$:PCBM-70 is demonstrated. Solution-processed small molecule p-DTS$(FBTTh_2)_2$ is used to achieve both high efficiency and low cost.

To introduce a p-DTS$(FBTTh_2)_2$ single cell into a tandem cell, a careful optimization is done ranging from basic structure tuning, DIO ratio, donor:acceptor ratio, thickness of active layer, annealing condition, to process condition. Fig. 1.(a) shows experimental transmittance spectra data of an organic layer stack that match well to the simulated transmittance data, confirming that the device multi-layer structure was formed as designed. J-V characteristics presented in Fig. 1(b) shows that V_{oc} of a tandem cell is same as the sum of each single cell's V_{oc}, indicating that the optimized tandem cell was successfully made.

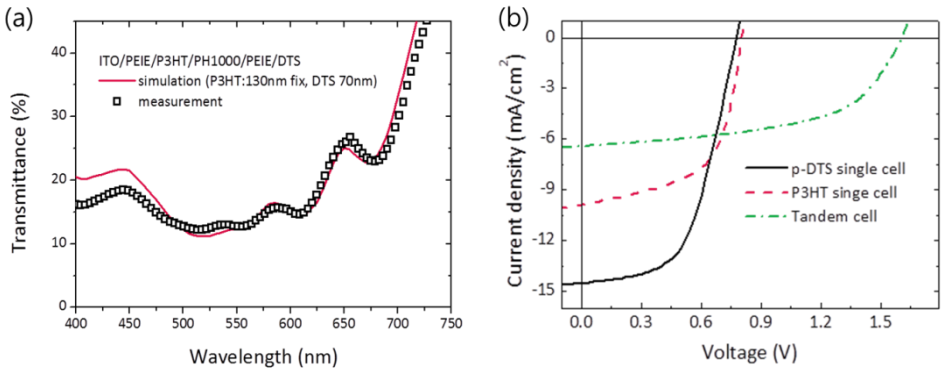

Fig. 1. (a) Simulated and measured transmittance data of a tandem structure (b) J-V characteristic of p-DTS$(FBTTh_2)_2$ based single cell, P3HT-based single cell, and a tandem cell made thereof.

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References

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