

HTL-free simplified organic solar cells using thermally triggered self-assembling of molecules at the interface

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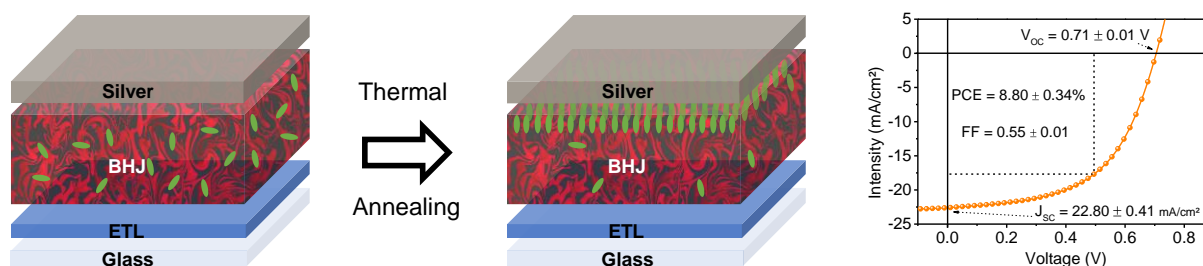
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Power conversion efficiencies of Organic photovoltaic (OPV) solar cells could reach, now, values over 19% [1][2][3]. Single-junction OPV cells require non-trivial solution processing of multiple layers on top of a transparent electrode: the electron transport layer (ETL), the active layer, the hole transport layer (HTL) and the top electrode. To minimize costs, reduction of the number of layers to be deposited will be a promising strategy. In this context, we present here a strategy to suppress the hole transport layer processing step. According a previous study [4], we investigated a series of carbazole based molecules to create a hole transport interface between the silver electrode and the bulk heterojunction. The molecules were introduced into the active layer ink based on PTQ10[‡], a promising industrially scalable donor polymer, and one of the most recent non-fullerene acceptor molecules, Y6[§].



After solar cell fabrication, we demonstrated that mild post-thermal annealing of the device enables the migration of molecules at the interface between the active layer and the silver electrode. Molecules embeds functional chemical moieties able to covalently self-assemble to silver. Thanks to meticulous process optimization, high-efficiency HTL-free OPV solar cells have been demonstrated with performances in the same order as those of control devices with conventional HTL. Even more interesting, these cells boast improved thermal and photostability.

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[‡]PTQ10: Poly [[6,7-difluoro(2-hexyldecyl)oxy]-5,8-quinoxalinediyl]-2,5-thiophenediyl]];

[§]Y6: 2,2'-[[12,13-Bis(2-ethylhexyl)-12,13-dihydro-3,9-diundecylbisthieno[2'',3'':4',5']thieno[2',3':4,5]pyrrolo[3,2-e:2',3'-g][2,1,3]benzothiadiazole-2,10-diyl]bis[methylidyne(5,6-difluoro-3-oxo-1H-indene-2,1(3H)-diylidene)]]bis[propanedinitrile]