

ST-P007

## Solution-processed Organic Trilayer Solar Cells Incorporating Conjugated Polyelectrolytes

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We report solution-processed organic trilayer solar cells consisting of poly (3-hexylthiophene) (P3HT), a conjugated polyelectrolyte (CPE) and [6,6]-phenyl-C61-butyric acid methyl ester (PCBM), wherein the effect CPE layer thickness on device properties was investigated. The current-voltage characteristics under illumination and dark as well as photoluminescence were characterized using various concentrations (0.02, 0.1, and 0.3wt%) of to deposit the CPE interlayer between the donor and acceptor layers. We also investigated the influence of molecular dipole moments in the trilayer solar cells by external stimuli. These results provide an experimental approach for investigating the influence of interfacial dipoles on solar cell parameters when placed between the donor and acceptor and allow us to obtaining fundamental information about the donor/acceptor interface in organic solar cells.

**Keywords:** organic solar cell, trilayer, conjugated polyelectrolyte

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## Achieving Robust N-type Nitrogen-doped Graphene Via a Binary-doping Approach

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Among various dopant candidates, nitrogen (N) atoms are considered as the most effective dopants to improve the diverse properties of graphene. Unfortunately, recent experimental and theoretical studies have revealed that different N-doped graphene (NGR) conformations can result in both p- and n-type characters depending on the bonding nature of N atoms (substitutional, pyridinic, pyrrolic, and nitrilic). To overcome this obstacle in achieving reliable graphene doping, we have carried out density functional theory calculations and explored the feasibility of converting p-type NGRs into n-type by introducing additional dopant candidates atoms (B, C, O, F, Al, Si, P, S, and Cl). Evaluating the relative formation energies of various binary-doped NGRs and the change in their electronic structure, we conclude that B and P atoms are promising candidates to achieve robust n-type NGRs. The origin of such p- to n-type change is analyzed based on the crystal orbital Hamiltonian population analysis. Implications of our findings in the context of electronic and energy device applications will be also discussed.

**Keywords:** graphene, doping