Organic Solar Cells Optimization through Novel PBDTT2F/PCE10 as Donors and PC70BM/ICBA as Acceptors in the Photoactive Layer

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Presently, we are using fossil fuels as a major source of energy, but due to the growing demand of energy and the fact that they are nonrenewable, scientists have been searching for a suitable alternative. So far, solar energy has shown promising signs to be a good candidate for an alternative energy source in the next fifty years or so, since it is renewable, economical and ecofriendly. This research aims to optimize the Power Conversion Efficiency (PCE) of organic solar cells by developing and attempting different cell conditions to manipulate the morphological order of the bulk heterojunction layer. A series of different conditions were tested on solar cells using for the first time PBDTT2F/PCE10 as donors and PC70BM/ICBA as acceptors in the photoactive layer. Accordingly, chlorobenzene and chloronaphthalene were used as solvents and additives with a concentration of 20-35 mg/ml. The solar cells' annealing temperature was 110°C for approximately 15 minutes (if annealed) following a spin speed that ranges between 750 and 3000 rounds per minute. As for the final layer, Calcium/Aluminum was deposited using physical vapor deposition. The conditions that have been tested using a solar simulator showed promising results of an efficiency up to 7% PCE using PBDDT2F. It has also shown a great potential of using PBDTT2F as a top layer in tandem solar cells. This is a step forward to obtaining an effective 15% PCE, which will contribute in developing revolutionary applications in different domains, for example, energy producing windows.

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