What is exciton diffusion length in organic photovoltaics?

Provided by the Springer Nature SharedIt content-sharing initiative The short exciton diffusion length associated with most classical organic semiconductors used in organic photovoltaics (5-20 nm)imposes severe limits on the maximum size of the donor and acceptor domains within the photoactive layer of the cell.

How long is exciton diffusion in organic bulk heterojunction solar cells?

The short-range diffusion length of organic semiconductors severely limits exciton harvesting and charge generation in organic bulk heterojunction solar cells. Here,the authors report exciton diffusion length in the range of 20 to 47 nmfor a wide range of non-fullerene acceptors molecules.

Can 3D exciton diffusion length be increased beyond 40 nm?

In summary,recent studies have shown that 3D exciton diffusion length in thin films of organic semiconductors can be increased beyond 40 nm by processing. This enables the use of larger donor and acceptor domain sizes in BHJs,which improve charge pair dissociation and extraction efficiencies.

Does exciton diffusion affect charge generation yield of low-offset organic solar cells?

In this work, the role of exciton diffusion in exciton dissociation and charge generation yield of low-offset organic solar cells is investigated. An expression for the exciton dissociation efficiency and effective dissociation rate constant is derived accounting for the exciton diffusion to and dissociation at the interface.

What is exciton diffusion length (LD)?

The distance that excitons can travel in their lifetimeis called the exciton diffusion length (LD). Figure 1. Schematic of OPV Solar Cell with Three Different Morphologies of the Active Layer Sandwiched between a Transparent and Reflecting Electrode Different colors represent electron donor and acceptor materials.

Can triplet excitons be used in organic photovoltaics?

A short exciton diffusion length (LD) is one of the main factors limiting the final power conversion efficiency (PCE) of organic photovoltaics (OPV). Aiming at overcoming this barrier,there have been studieson the use of longer-lived triplet excitons,which can be introduced either through triplet sensitiz Recent Review Articles

EXCITON DIFFUSION LENGTH ORGANIC PHOTOVOLTAICS

Organic photovoltaic cells are partiuclarly sensitive to exciton harvesting and are thus, a useful platform for the characterization of exciton diffusion. While device photocurrent spectroscopy

Semantic Scholar extracted view of "Exciton diffusion length and charge mobility in donor and acceptor materials in organic photovoltaics: Tetrabenzoporphyrin and silylmethyl[60] fullerene" by H. Tamura et al. Exciton diffusion is of great importance to the future design of high efficiency organic photovoltaics. Exciton diffusion studies

Exciton binding energy (Eb) plays an essential role in organic electronics. For organic solar cells, the existence of Eb necessitates interfacial energy level offsets to drive exciton dissociation into free charge carriers at the donor/acceptor interfaces, which results in an extra energy loss with respect to inorganic and perovskite solar cells. Thus, it is highly desirable to ???

EXCITON DIFFUSION LENGTH ORGANIC PHOTOVOLTAICS

Iodination has unlocked new potentials in organic photovoltaics (OPVs). A newly designed and synthesized iodinated non-fullerene acceptor, BO-4I, showcases exceptional excitation delocalization property with the exciton diffusion length increased to 80 nm.

Progress and Potential: Organic photovoltaic solar cells (OPVs) have made remarkable progress, with lightweight and flexible solar modules now becoming commercially available Because the exciton diffusion length in organic semiconductors is typically much shorter than the light absorption depth (~100 nm), planar donor-acceptor

Photoconversion in planar-heterojunction organic photovoltaic cells (OPVs) is limited by a short exciton diffusion length (LD) that restricts migration to the dissociating electron donor/acceptor

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While non-fullerene acceptors (NFAs) have recently been demonstrated to exhibit long-range exciton diffusion, most organic photovoltaic and photodetector studies still focus on blended polymer: NFA systems. ???

Strongly improved exciton diffusion lengths or a greater exciton delocalization at room temperature are sought-after 12,13 because this should allow novel design principles or add new directions

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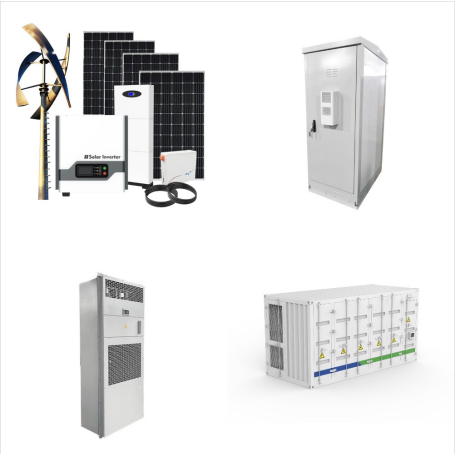
In several applications, in particular in organic photovoltaics (OPVs), OS materials with high diffusion lengths (Lpropto sqrt{Dtau }) (where D and ?? are the exciton diffusion constant and

A physical model of exciton diffusion length in organic photovoltaic cell based on percolation theory and Forster resonant transfer rate is presented here. The calculated results show a good agreement with Monte Carlo simulation and experimental data, indicating that the proposed model can well describe the temperature and material disorder



Exciton generation, migration, and dissociation are key processes that play a central role in the design and operation of many organic optoelectronic devices. In organic photovoltaic cells, charge generation often occurs only at an interface, forcing the exciton to migrate from the point of photogeneration i

EXCITON DIFFUSION LENGTH ORGANIC PHOTOVOLTAICS

While non-fullerene acceptors (NFAs) have recently been demonstrated to exhibit long-range exciton diffusion, most organic photovoltaic and photodetector studies still focus on blended polymer: NFA systems. Herein, a 40 nm exciton diffusion length for IT4F excitons is determined, and it is demonstrated that sharp interface, planar

We studied crystallinity and exciton harvesting in bulk heterojunctions of the semiconducting polymer PffBT4T-2OD and electron acceptor PC71BM that are used to make highly efficient organic solar cells. Grazing incidence wide-angle X-ray scattering shows that the size of crystalline domains of PffBT4T-2OD increases to ?? 1/4 18 nm in photovoltaic blends upon thermal ???

Our results demonstrate the advantages of large crystalline domains in organic photovoltaics, providing exciton diffusion is sufficient. Because the exciton diffusion length in organic

EXCITON DIFFUSION LENGTH ORGANIC PHOTOVOLTAICS

We evaluate the exciton diffusion length and the charge mobility in organic crystals. ??? The exciton diffusion length in a donor material for organic photovoltaics is few hundred nm. ??? The charge and exciton transports exhibit pronounced anisotropies.

For the process of photovoltaic conversion in organic solar cells (OSCs) and quantum???dot solar cells (QDSCs), three of four steps are determined by exciton behavior, namely, exciton generation, exciton diffusion, and exciton dissociation. Therefore, it is of great importance to regulate exciton behavior in OSCs and QDSCs for achieving high power conversion ???

The distance that excitons can travel is a key parameter for organic photovoltaic materials. In the August issue of Science Advances, Sneyd and colleagues report a breakthrough in increasing exciton diffusion length to 300 nm by using highly ordered nano???bers. This approach can enable simpler and more stable solar cells. Organic

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Since exciton behavior plays a crucial role in photovoltaic conversion of OSCs and QDSCs, more efforts should be made to regulate it and then boost PCEs: (1) developing unified and reliable methods to measure the intrinsic L D and that in devices; (2) seeking efficient strategies to prolong the exciton lifetime of organic semiconductors and QDs

Typical organic photovoltaic semiconductors exhibit high exciton binding energy (E b, typically >300 meV), hindering the development of organic solar cells based on a single photovoltaic material (SPM-OSCs).Herein, compared with the control molecule (Y6), Y6Se with selenium substitution exhibits reduced E b and faster relaxation of the exciton state or the ???

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Under the isotropic exciton diffusion assumption, one can estimate the exciton diffusion length via the Einstein relation: 5 (L_D = AR_0^3/d^2), where L D is the diffusion length, R 0 is the

Exciton diffusion length and graded vertical phase separation of the active layer play a critical role in the realization of high-performance thick-film organic solar cells (OSCs). Here, authors

Diffusion of excited state energy is a key process in both photosynthesis 1 and in organic optoelectronic devices 2,3,4,5,6 organic heterojunction photovoltaic devices (OPVs), the formed

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? Exciton diffusion and carrier transport are two critical factors that determine the efficiency of organic photovoltaics (OPVs). However, the relationship between these two ???

Organic photovoltaics (OPVs) are an emerging solar cell technology that is cost-effective 1,2,3, lightweight 4,5 and flexible 4,6,7,8.Moreover, owing to their energy-efficient production and non

By incorporating BTP-eC7 as a third component, without expanding absorption range or changing molecular energy levels but regulating the ultrafast exciton diffusion and HT processes, the power conversion efficiency (PCE) of the optimized PM6:BTP-eC9:BTP-eC7 based ternary OSC is improved from 17.30% to 17.83%, primarily due to the enhancement of

EXCITON DIFFUSION LENGTH ORGANIC PHOTOVOLTAICS

Organic photovoltaics (OPVs) promise cheap and flexible solar energy. the hole diffusion length would be less than 15 nm. We fabricated single component Y6 devices. Exciton diffusion

Iodination has unlocked new potentials in organic photovoltaics (OPVs). A newly designed and synthesized iodinated non-fullerene acceptor, BO-4I, showcases exceptional excitation delocalization property with the exciton diffusion length increased to 80 nm. The enhanced electron delocalization property is attributed to the larger atomic radius and electron ???