

European Solar Energy Storage

Does low exciton binding energy mean good solar cell efficiency



Overview

Minimizing the E_b of the photovoltaic materials can facilitate the exciton dissociation in low-driving force organic solar cells (OSCs) and thus improve the power conversion efficiency (PCE); nevertheless, diminishing the E_b with deliberate design principles remains a significant challenge.

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It is precisely because exciton-dissociation yields are low in bulk material that all practical organic solar cells employ a heterojunction (HJ) with an energy offset between the energy levels of the electron donor and acceptor layers that provides the free energy required to obtain efficient dissociation.^{13,14,19,20} The situation for an .

Exciton binding energy (E_b) plays an essential role in organic electronics. For organic solar cells, the existence of E_b necessitates interfacial energy level offsets to drive exciton dissociation .

Direct measurement of the exciton binding energy shows that the impressive performance of perovskite solar cells arises from the spontaneous generation of free electrons and holes after.

We designed unprecedented polymeric materials for organic solar cells fabrication via the data-driven machine learning and deep learning approaches bearing extremely low exciton binding energy, and high synthetic accessibility.

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Thermodynamic efficiency limit of excitonic solar cell

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Small Exciton Binding Energies Enabling Direct Charge ...

Direct photogeneration of free charge carriers enabled by remarkably low exciton binding energies is demonstrated in the state-of-the-art nonfullerene acceptor of Y6 by a joint experimental and theoretical study.



Solar cell exciton binding energy

The exciton is elementary excitation of condensed matter. It exists in insulators and semiconductors, and simply is a bound state of electron and hole [binding energy is the amount of energy



Promising excitonic absorption for efficient perovskite ...

However, the full potential of excitonic absorption is not really realized in present efficient solar cells, including silicon (Si), gallium arsenide (GaAs), organic solar cells, etc., due to the difficulty in regulating the exciton ...



Direct measurement of the exciton binding energy and effective ...

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Reduced exciton binding energy and diverse molecular

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High-voltage organic solar cells (OSCs) have received increasing attention because of their promising applications in tandem devices and indoor photovoltaics, but the trade-off between energy loss and charge generation induced by exciton binding energy (E_b) has become one of the biggest bottlenecks limiting the development

of this field.



Exciton Dynamics in Layered Halide Perovskite ...

In contrast, efficient energy funneling in an n-optimized landscape bypasses low n phases with high exciton-phonon coupling and thus enhances radiative recombination efficiency.



Computational design of new polymers having low exciton binding energy

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Thermodynamic efficiency limit of excitonic solar cells

Here, we show that the Second Law of Thermodynamics limits the maximum efficiency of excitonic solar cells below the maximum of 31% established by Shockley and Queisser [J. Appl. Phys. 32, 510 (1961)] for inorganic solar cells (whose exciton-binding energy is ...



Solar Cell Efficiency: What it is and How it's Measured

Conclusion Solar cell efficiency plays a vital role in harnessing the power of sunlight to generate electricity. Understanding the factors, measurement methods, and advancements in solar cell efficiency is crucial for ...



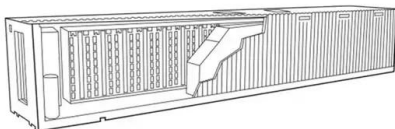
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Exciton Binding Energy

Exciton binding energy is defined as the energy required to separate an exciton into its constituent electron and hole, calculated using a simple Wannier exciton model, where it depends on the reduced effective mass of the electron and hole and the high-frequency dielectric constant.



Exciton Binding Energies in Organic Photovoltaic Materials: A

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Small Exciton Binding Energies Enabling Direct Charge

Organic solar cells (OSCs) with nonfullerene acceptors (NFAs) exhibit efficient charge generation under small interfacial energy offsets, leading to over 18 % efficiency for the single-junction devices based on the state-of-the-art NFA of Y6.



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Solar cell exciton binding energy

The binding energy refers to the minimum energy of separating a pair of hole and electron. The importance of a binding energy can be directly related to the current flow within a solar



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Direct measurement of the exciton binding energy shows that the impressive performance of perovskite solar cells arises from the spontaneous generation of free electrons ...

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