What is a bulk heterojunction structure of a solar cell?

Besides,the active regionof the organic solar cell is in the bulk heterojunction structure formed by blending organic semiconductors acting as donors and acceptors. In this respect,the bulk heterojunction forms a much larger heterojunction interface distributed throughout the entire layer.

What are organic photovoltaic cells?

Organic photovoltaic cells (OPVs) consist of a nanostructured blend of donor (D) and acceptor (A) semiconductors(1,2). Photons absorbed in either material create molecular excitons,which can dissociate at the D-A heterojunction into holes on D and electrons on A (3,4).

How efficient are organic solar cells with a hybrid planar/bulk heterojunction?

Hong,L. et al. 18.5%efficiency organic solar cells with a hybrid planar/bulk heterojunction. Adv. Mater.33,2103091 (2021). Li,C. et al. Achieving record-efficiency organic solar cells upon tuning the conformation of solid additives. J. Am. Chem. Soc.144,14731-14739 (2022).

Are bilayer organic solar cells more efficient than bulk heterojunctions?

Bilayer organic solar cells can be as efficientas their bulk heterojunction counterparts. The photophysics of bilayer devices is fundamentally different to bulk heterojunctions. Long range interlayer energy transfer plays a key role in boosting bilayer device efficiency.

What are organic solar cells?

Organic solar cells (OSCs),which enable the expansion of the application areas of photovoltaic technology,have gained significant prominence in science and industry due to their numerous advantages 1,2.

Why are heterojunction-based solar cells important?

This is vitally important in order to achieve high power conversion efficienciesin organic solar cells. Early heterojunction-based solar cells were limited to relatively modest efficiencies (<4%) owing to limitations such as poor exciton dissociation,limited photon harvesting,and high recombination losses.

We demonstrate that an optimized layer-by-layer organic photovoltaic can effectively improve the photophysical properties of the device, resulting in a conversion efficiency of 16.21%, ???

The power conversion efficiency of organic photovoltaic cells has increased with the introduction of the donor???acceptor heterojunction that serves to dissociate strongly bound photogenerated excitons1. Further efficiency increases have been achieved in both polymer2,3 and small-molecular-mass4 organic photovoltaic cells through the use of the bulk ???

The fundamental understanding provided by this model leads us to infer that the maximum power conversion efficiency of double heterostructure organic photovoltaic cells can be as high as 12%. When combined with mixed layers to increase photocurrent and stacked cells to increase ${V}_{mathrm{OC}}$, efficiencies approaching 16% are within reach.

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

A layer-by-layer organic photovoltaic device with excellent performance is created by tuning individual layers. Kumari et al. report 16.21% efficiency, surpassing the bulk heterojunction equivalent device, and demonstrate improved photostability and thermal stability for nine different non-fullerene acceptor systems.

Small molecule based organic photovoltaic cells have attracted considerable interest as a potential solution for low-cost solar energy conversion in the near future. In this review, we first discuss the operation, advantages, and limitations of three different molecular donor-acceptor heterojunction structures.

The first inorganic solar cell was developed at Bell Laboratories in 1954 [8] was based on Si and had an efficiency of 6%. Over the years the efficiency has reached 24% for crystalline Si solar cells in the laboratory [9].Today Si-based solar cells are by far the most dominating type of PVs used and account for 99% of all PVs [10].With increasing efficiency ???

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

Material insights and challenges for non-fullerene organic solar cells based on small molecular acceptors. Nat. Energy. 2018; 3:720-731. Single-junction organic solar cell with over 15% efficiency using fused-ring acceptor with electron-deficient core enhanced efficiencies via a network of internal donor-acceptor heterojunctions

The device efficiency of organic solar cells is usually limited by the inherent energy loss during carrier transport. Here, authors integrate bulk heterojunction organic photovoltaic with vertical

For efficient exciton separation, donor and acceptor domains should be distributed on a comparable length scale to the exciton diffusion length (???10 nm), thus efficient organic solar cells and photodetectors have been developed in a configuration of D:A mixed bulk-heterojunctions (BHJs).

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

Graded bulk-heterojunction organic solar cell with well-defined vertical phase separation has the potential to surpass the classical counterpart, thus the optimisation of this structure is crucial

The power conversion efficiency of small-molecular-weight and polymer organic photovoltaic cells has increased steadily over the past decade. This progress is chiefly attributable to the introduction of the donor???acceptor heterojunction that functions as a dissociation site for the strongly bound photogenerated excitons.

The relative molecular orientation at the donor???acceptor interface is a key factor that determines photocurrent generation in organic photovoltaics. The effects of this orientation on the

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

Organic solar cells (OSCs) have been developed for few decades since the preparation of the first photovoltaic device, and the record power conversion efficiency (PCE) certified by national renewable energy laboratory (NREL) has exceeded 17%.

Recently Heliatek [5], a German firm, has achieved a record conversion efficiency of 13.2% for an Organic Photovoltaic (OPV) Multi-junction (MJ) cell using small molecules. The cell has three absorber layers for absorbing light from the near infrared, red and green wavelengths, covering the major part of the solar spectrum from 450 nm to 950 nm.

Solution-processed bilayer organic solar cells (OSCs) with high performance are demonstrated for nonfullerene small molecular acceptors (NFAs). Unlike fullerene acceptors, NFAs show significant spectral overlap between their absorption and the photoluminescence (PL) of a polymer donor, which makes the design of an efficient exciton-harvesting bilayer ???

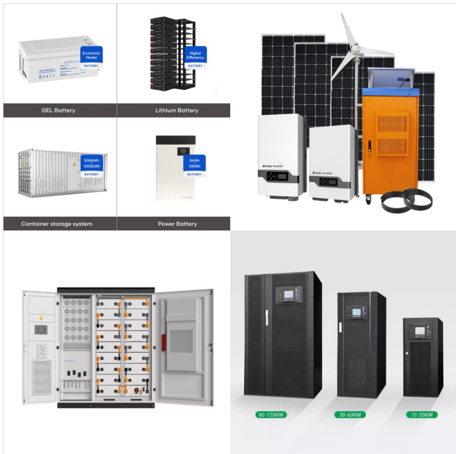
ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

We have fabricated an efficient organic photovoltaic cell based on a heterojunction of pentacene and C60. Photocurrent action spectra exhibit broad light-harvesting throughout the visible spectrum with a peak external quantum efficiency (EQE) of 58?4% at short-circuit condition. Modeling studies indicate that this high EQE can be partly attributed to the large ???

Though single-material organic solar cells are attractive for next-generation photovoltaic technologies, designing new materials with ideal properties remains a challenge. Here, the authors report

The development of organic photovoltaic (OPV) cells has long been guided by the idea that excitons ??? bound electron-hole pairs created by light absorption ??? diffuse only 5???10 ???

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS



DOI: 10.1021/acsenergylett.0c00564 Corpus ID: 219048942; Efficient Exciton Diffusion in Organic Bilayer Heterojunctions with Nonfullerene Small Molecular Acceptors @article{Lee2020EfficientED, title={Efficient Exciton Diffusion in Organic Bilayer Heterojunctions with Nonfullerene Small Molecular Acceptors}, author={Tack Ho Lee and Song Yi Park and ???

The molecular interactions at an organic heterointerface govern the performance of many optoelectronic devices. Through a combination of synthesis, spectroscopy and modelling, it has now been

Organic solar cells (OSCs), as a promising low-cost, lightweight and flexible photovoltaic technology, have attracted extensive attentions in the last decade 1,2,3 spite the rapid development of

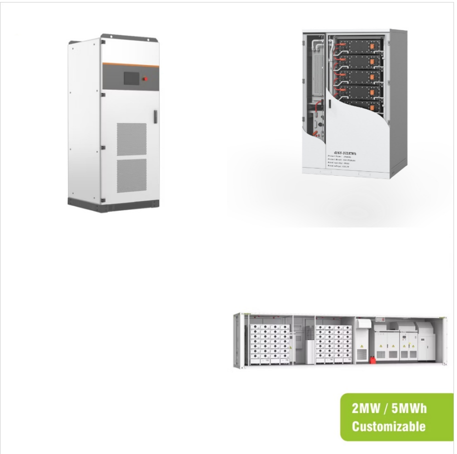
ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS

Small Molecular Donor/Polymer Acceptor Type Organic Solar Cells: Effect of Molecular Weight on Active Layer Morphology. Macromolecules 2019, 52 (22) 14.7% Efficiency Organic Photovoltaic Cells Enabled by Active Materials with a Large Electrostatic Potential Difference. Journal of the American Chemical Society 2019, 141

Recently, organic solar cells have surpassed 17% 1,2 power conversion efficiency (PCE) in single-absorber layer bulk heterojunction (BHJ) devices based upon non-fullerene electron acceptor systems

Improving the photovoltaic performance directly by innovative device architectures contributes much progress in the field of organic solar cells. Photovoltaic device using different kinds of

ORGANIC PHOTOVOLTAIC CELLS WITH MOLECULAR HETEROJUNCTIONS



Energy level alignment (ELA) at donor (D) -acceptor (A) heterojunctions is essential for understanding the charge generation and recombination process in organic photovoltaic devices. However, the

1 Organic solar cells (OSCs) made up of active layers based on a bulk heterojunction (BHJ) (mixer of organic semiconducting donor and acceptor materials) concept have become one of the chief

We demonstrate efficient organic photovoltaic cells employing a photoactive region composed of a mixed donor-acceptor molecular layer, the properties of which were introduced in the preceding