Organic photovoltaics materials

Organic Photovoltaics: Mechanisms, Materials, and Devices fills this gap. The book provides an international perspective on the latest research in this rapidly expanding field with contributions from top experts around the world. It presents a unified approach comprising three sections: General Overviews; Mechanisms and Modeling; and Materials ...

An organic solar cell uses carbon-based materials and organic electronics instead of silicon as a semiconductor to produce electricity from the sun. Organic cells are also sometimes referred to as "plastic solar cells" or "polymer solar cells." ... While organic photovoltaics are an exciting new technology, there"s a long way to go before they ...

The development of organic semiconductors for photovoltaic devices, over the last three decades, has led to unexpected performance for an alternative choice of materials to convert sunlight to electricity.

This is due to the organic materials degrading at a much faster rate when exposed to the environment. Organic photovoltaic cell components. Both organic solar cells and traditional silicon cells are structured almost identically. As mentioned previously, the only structural difference between the two cell types is the material that acts as the ...

Near-infrared (NIR)-absorbing organic semiconductors have opened up many exciting opportunities for organic photovoltaic (OPV) research. For example, new chemistries and synthetical methodologies have been developed; especially, the breakthrough Y-series acceptors, originally invented by our group, specifically Y1, Y3, and Y6, have contributed immensely to ...

The open-circuit voltage of organic solar cells is usually lower than the values achieved in inorganic or perovskite photovoltaic devices with comparable bandgaps. Energy losses during charge ...

Organic Photovoltaic Solar Cells. NREL has strong complementary research capabilities in organic photovoltaic (OPV) cells, transparent conducting oxides, combinatorial methods, ...

Organic solar cells, also known as organic photovoltaics (OPV), utilize organic materials to convert sunlight into electricity. They operate based on the absorption of photons ...

Yao, H. et al. 14.7% efficiency organic photovoltaic cells enabled by active materials with a large electrostatic potential difference. J. Am. Chem. Soc.141, 7743-7750 (2019). Markina, A. et al. Chemical design rules for non-fullerene acceptors in organic solar cells. Adv. Energy Mater.11, 2102363 (2021).

This Review surveys recent progress in semitransparent organic photovoltaic devices and discusses strategies to optimize their efficiency, visible transparency, lifetime and ...

This is an extrinsic source of degradation; organic materials are sensitive to water and oxygen causing photooxidation of the organic layers and interfaces. ... His research activity is centered on the fabrication, characterization, and understanding of fundamental processes in organic photovoltaic, photodetecting, and light-emitting devices. ...

The certified power conversion efficiency (PCE) of organic photovoltaics (OPV) fabricated in laboratories has improved dramatically to over 19% owing to the rapid development of narrow-bandgap ...

The versatility of organic photovoltaics is already well known and this completely revised, updated, and enlarged edition of a classic provides an up-to-date overview of this hot topic. The proven structure of the successful first edition, divided into the three key aspects of successful device design: materials, device physics, and ...

Sun, W. et al. Machine learning-assisted molecular design and efficiency prediction for high-performance organic photovoltaic materials. Sci. Adv. 5, eaay4275 (2019).

Organic photovoltaics offers unique potential for the generation of environmentally friendly electrical energy. The semiconducting materials essentially consist of hydrocarbons, ranging from small molecules to polymers.

Organic photovoltaic (OPV) cells, also known as organic solar cells, are a type of solar cell that converts sunlight into electricity using organic materials such as polymers and ...

Organic photovoltaic (OPV) materials are promising candidates for cheap, printable solar cells. However, there are a very large number of potential donors and acceptors, making selection of the ...

Organic photovoltaic cells are thin, lightweight, flexible and semi-transparent. These characteristics unlock new possibilities for applications in agriculture, architecture, ...

Organic photovoltaics are remarkably close to reaching a landmark power conversion efficiency of 20%. Given the current urgent concerns regarding climate change ... To achieve an efficient photovoltaic performance in organic materials requires both components to overcome the binding energy of the initial photogenerated exciton to create free ...

Herein, organic solar cell configurations, organic donor and acceptor materials, basic concepts in photovoltaic parameters, and device operation physics are introduced. Organic solar cells can be classified as single layer, bilayer, bulk heterojunction, and ordered heterojunction configurations.

Nature Reviews Materials2023 Cite this article The narrow and intense absorption spectra of organic materials open up the opportunity to develop efficient organic photovoltaic devices that are qualitatively different from other, incumbent solar cell technologies.

Organic photovoltaics materials

Over the past 20 years, significant progress has been made in organic photovoltaics (OPVs) due to its advantages of being cost-effective, being lightweight, and having flexible manufacturability.

Organic photovoltaics (OPVs) have rapidly improved in efficiency, with single-junction cells now exceeding 18% efficiency. These improvements have been driven by the adoption of new non-fullerene ...

Organic solar cells, on the other hand, are made by depositing a thin layer of photovoltaic material onto a substrate, such as glassorpolymericmaterial.Theycanalsobemadeintoavariety of shapes and sizes, making them more versatile. However, organic solar cells currently have lower efficiency rates and

Excitons in organic materials have a binding energy 2 of 0.5 - 1 eV, due to their low dielectric permittivity 3 (? = 3 - 4). In comparison, thermal energy (kT) at a room temperature (298 K) is approximately 0.025 eV, substantially lower than the binding energy (0.5 - 1 eV) of an exciton in an organic material. Thus, if the organic ...

In the last few decades, organic solar cells (OSCs) have drawn broad interest owing to their advantages such as being low cost, flexible, semitransparent, non-toxic, and ideal for roll-to-roll large-scale processing. Significant advances have been made in the field of OSCs containing high-performance active layer materials, electrodes, and interlayers, as well as ...

NREL developed the Computational Database for Active Layer Materials for Organic Photovoltaic Solar Cells with calculations on electronic properties of tens of thousands of new polymers and small molecules that are potential candidates for new absorbers.

Broadening the optical absorption of organic photovoltaic (OPV) materials by enhancing the intramolecular push-pull effect is a general and effective method to improve the power conversion efficiencies of OPV cells. However, in terms of the electron acceptors, the most common molecular design strategy of halogenation usually results in down ...

Near-infrared (NIR)-absorbing organic semiconductors have opened up many exciting opportunities for organic photovoltaic (OPV) research. For example, new chemistries and synthetical methodologies have been ...