

The development of photovoltaic solar materials

Why are materials important for solar photovoltaic devices?

Hence, the development of materials with superior properties, such as higher efficiency, lower cost, and improved durability, can significantly enhance the performance of solar panels and enable the creation of new, more efficient photovoltaic devices. This review discusses recent progress in the field of materials for solar photovoltaic devices.

What are new materials for solar photovoltaic devices?

This review discusses the latest advancements in the field of novel materials for solar photovoltaic devices, including emerging technologies such as perovskite solar cells. It evaluates the efficiency and durability of different generations of materials in solar photovoltaic devices and compares them with traditional materials.

What is a photovoltaic (PV) cell?

The journey of photovoltaic (PV) cell technology is a testament to human ingenuity and the relentless pursuit of sustainable energy solutions. From the early days of solar energy exploration to the sophisticated systems of today, the evolution of PV cells has been marked by groundbreaking advancements in materials and manufacturing processes.

How sustainable is photovoltaic technology?

Furthermore, the sustainability of these technologies is paramount, with an emphasis on recyclability and environmentally friendly production processes to ensure the sustainable growth of solar technology. The outlook for photovoltaic materials is both dynamic and full of promise.

How a photovoltaic solar cell can be fabricated?

Schematic diagram of a photovoltaic (PV) solar cell and the futuristic next-generation model PV solar cells can be fabricated by using various semiconducting materials, in which cell parameters play a crucial role in the photovoltaic solar cell's performance.

Are photovoltaic materials efficient?

Recent developments in photovoltaic materials have led to continual improvements in their efficiency. We review the electrical characteristics of 16 widely studied geometries of photovoltaic materials with efficiencies of 10 to 29%.

World energy consumption. Taken from [1] Solar energy is the energy obtained from solar radiation, and it is regarded as renewable since the Sun's expected life is still between 5000 and 10,000 billion years; furthermore, this kind of energy is available in most of the Earth's places.

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In the 1960s, the photovoltaic system for the first time was employed in commercial applications for space solar cells to deliver the power for satellite applications, and silicon semiconductor materials have been reported to be widely used in photovoltaic technology . Moreover, in spite of the extensive use of silicon semiconductor-based technology, it has a ...

The density functional theory calculations of perovskite photovoltaic materials, including designing lead-free materials, studying the mechanism of humidity degradation, and exploring the origin of photocurrent-voltage hysteresis, can bring benefits to the development of perovskite-based solar cells. Download: Download high-res image (166KB)

In this paper, efforts have been made to study the universal and advanced compound-based materials that are used to fabricate the solar PV cells, their generations of development and characteristic properties required. The materials are first categorized in four generations from the beginning of solar cells innovation to till date followed by ...

Photovoltaic solar energy (PV) is expected to play a key role in the future ...

Organic solar cells have emerged as promising alternatives to traditional inorganic solar cells due to their low cost, flexibility, and tunable properties. This mini review introduces a novel perspective on recent advancements in organic solar cells, providing an overview of the latest developments in materials, device architecture, and performance ...

Recent developments in photovoltaic materials have led to continual improvements in their efficiency. We review the electrical characteristics of 16 widely studied geometries of photovoltaic materials with efficiencies of 10 to 29%. Comparison of these characteristics to the fundamental limits based on the Shockley-Queisser detailed-balance ...

Photovoltaic solar energy (PV) is expected to play a key role in the future global sustainable energy system. It has demonstrated impressive developments in terms of the scale of deployment, cost reduction and performance enhancement, most visibly over the past decade. PV conversion is and can be done with a wide range of materials, device ...

PV solar cells can be fabricated by using various semiconducting materials, in which cell parameters play a crucial role in the photovoltaic solar cell's performance. Hence, selecting appropriate materials becomes important to fabricate PV solar cells to achieve high performance with high efficiency at low cost. A photovoltaic solar cell has ...

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The rapid growth and evolution of solar panel technology have been driven by continuous advancements in materials science. This review paper provides a comprehensive overview of the diverse range of materials employed in modern solar panels, elucidating their roles, properties, and contributions to overall performance. The discussion encompasses both ...

This review discusses the latest advancements in the field of novel materials ...

It is a time-consuming and costly process to develop affordable and high-performance organic photovoltaic materials. Computational methods are essential for accelerating the material discovery ...

Researchers have concentrated on increasing the efficiency of solar cells by creating novel materials that can collect and convert sunlight into power. This study provides an overview of the recent research and development of materials for solar photovoltaic devices.

The main goal of this review is to show the current state of art on photovoltaic cell technology in terms of the materials used for the manufacture, efficiency and production costs. A comprehensive comparative analysis of the four generations is performed, including the device architectures, their advantages and limitations. Special emphasis is ...

In the realm of organic photovoltaic materials, recent research has underscored the development of innovative materials and processing techniques. Yu-Wei Su et al. [141] discuss advancements such as sequential deposition and layer-by-layer methods that enhance power conversion efficiency and expand potential applications, including in ...

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