Principle of fiber-shaped solar cells

What are fiber-shaped solar cells?
Fiber-shaped solar cells are a type of low cost and flexible photoelectrodes fabricated using materials such as metal,optical fiber,and conductive fiber. They broke the limitations of traditional flexible solar cells in terms of shapes and materials.

How do fiber-shaped solar cells work?
The working principle of fiber-shaped solar cells is similar to that of planar solar cells,and the functional layers are closely attached to each other to realize efficient charge transport. In addition,to reduce charge recombination (leakage current),full coverage of the functional layers on the fiber substrates is required.

How are coaxial fiber solar cells constructed?
Coaxial fiber solar cells derived from the sandwich structure of planar devices are constructed by laying functional materials onto fiber optic substrates(Fig. 2 f). Typically,the configuration is an outer electrode/HTL/perovskite layer/ETL/inner electrode (Fig. 2 e).

Can fiber solar cells be integrated?
Most current integration techniques are based on traditional planar solar cell technologies. The domain of fiber solar cells remains under-exploredin terms of system integration methodologies and the design of external circuitry,indicating a substantial research gap that requires attention.

Is there a research gap in fiber solar cells?
The domain of fiber solar cells remains under-explored in terms of system integration methodologies and the design of external circuitry,indicating a substantial research gapthat requires attention. Ya Liu: Conceptualization,Investigation,Writing - original draft,Writing - review &editing.

Are polymer-based solar cells flexible?
Polymer-based solar cells are widely studied as the most potential flexiblesolar cells because polymer materials have the highest flexibility,film forming ability,and mechanical toughnesscompared with those of other material systems. There are two types of polymer solar cells: the standard type and inverted type.

Although the current power conversion efficiency of 10.79% has been already achieved, the used noble metal of Au fiber and film greatly increase the cost and weight of the fiber-shaped perovskite solar cells, limiting its practical application. 75 Compared with noble metal, CNT fiber has been considered as the potential candidate electrodes for high ...

The past five years witnessed fast growth of fiber solar cells, thanks to the development of novel materials and fabrication process. In this chapter, novel device ...

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Fiber-shaped dye-sensitized solar cells (FDSSC) is the best configuration in term of applicability. In 2019, an efficient flexible DSSC was prepared by methodical growth of TiO 2 nanotubes grown on Ti wire serving as the photoanode and sequential growth of polyaniline layers and Co0.85Se nanosheets on the surface of carbon fibers serving as the CEs.

The working principle of the DSSC is based on the absorption of photons and excitation of the dye, followed by fast electron injection into the conduction band (CB) of the TiO 2 surface. Figure 1 (B) shows the operation principle of the DSSC. Dye molecules absorb the incident photons and get excited from a low-energy state (HOMO-highest occupied molecular ...

The research on perovskite solar cells is currently in full swing and has derived many types of special solar architectures. Fiber-shaped perovskite solar cell (FPSC) is one largely important of ...

Wang D, Hou S, Wu H, et al. Fiber-shaped all-solid state dye sensitized solar cell with remarkably enhanced performance via substrate surface engineering and TiO 2 film modification. J Mater Chem, 2011, 21, 6383 doi: ...

Fiber-shaped dye-sensitized solar cells (FDSSCs) represent promising futuristic flexible or wearable power sources, owing to their simple fabrication process, light weight, weavability, and wearability. Along with strategies on changing the properties of semiconductor materials, the effects of incorporating silver-embedded SiO2 nanoparticles (Ag@SiO2 NPs) on ...

In this section, fiber-shaped polymer solar cells (PSCs) that exhibit unique and promising advantages such as lightweight and weaveability are presented. New materials and ...

Generally, ber-shaped solar cells [18, 20-28] adopt three different device structures, in which cathodes and anodes are coaxially [29-32], twistingly [33] or parallelly [25] assem-bled. The working principle of ber-shaped solar cells is similar to ...

In this chapter, the working mechanism for traditional silicon-based solar cells is first summarized to elucidate the physical principle in photovoltaics. The main efforts are then made to discuss the different mechanisms for different types of solar cells, i.e. dye-sensitized solar cells, polymer solar cells, and perovskite solar cells.

Herein, recent advances in the development of fiber-shaped perovskite solar cells, including those relating to device structure evolution and working principles, as well as ...

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