Micro lenses in thin film organic photovoltaic cells

As thin active organic films often are desired due to electrical limitations such as poor mobilities and low built in electric fields, the light trap can be a tool to remedy the mismatch of...

Thin-film solar cells are a type of solar cell made by depositing one or more thin layers (thin films or TFs) of photovoltaic material onto a substrate, such as glass, plastic or metal. Thin-film solar cells are typically a few nanometers to a few microns thick-much thinner than the wafers used in conventional crystalline silicon (c-Si) based solar cells, which can be up to 200 mm thick.

Previously, a light trap incorporating a micro-lens array has been shown to be successful on an organic solar cell [19], [20]. Here, a low cost fabrication method is presented that requires less fabrication steps and is industrially scalable. ... Trapping light with micro lenses in thin film organic photovoltaic cells. Opt. Express, 16 (2008 ...

Such thin-film micro-concentrator PV modules would use significantly less semiconductor solar cell material (reducing the use of critical raw materials) and lead to a higher energy production (by ...

micro-lens solar cell with a vertex angle of 110°and a groove depth of 300mm. The second is a non-micro-lens solar cell. Under the existing micro-lens processing conditions, a micro-lens light trapping structure with a vertex angle of 60° and a groove depth of 400mm has a nearly optimal performance for different wavelength light [6].

At present, Building integrated photovoltaic (BIPV) has become a research hotspot in the field of building energy conservation [[1], [2], [3]]. And it has been one of the most widely application scenarios of thin film solar cells, because thin film solar cells have excellent power generation performance under low light conditions, and their materials are flexible and light [4,5].

Multi-scale and angular analysis of ray-optical light trapping schemes in thin-film solar cells: Micro lens array, V-shaped configuration, and double parabolic trapper. Changsoon Cho and Jung ...

We demonstrate a novel light trapping configuration based on an array of micro lenses in conjunction with a self aligned array of micro apertures located in a highly reflecting mirror.

In this paper, an optimal design method of micro-lens light trapping structure for thin film solar cells applied to building integrated photovoltaic (BIPV) is proposed.

Here, thin film organic photovoltaics with nano-sized phase separation integrated in micro-sized surface

topology is demonstrated as an ideal solution to proposed applications.

Could nanostructures act as lenses to focus incident light for efficient utilization of photovoltaics? ... band light trapping in thin film solar cell. Opt. Express 20, A560-A571 (2012 ...

Organic solar cells have been attracting considerable attention owing to their potential merit of low cost energy conversion. The power conversion efficiency (PCE) of organic solar cells has been increased up to 9.2% for a single junction configuration [1] and over 12% for a tandem structure [2].Due to limited charge carrier mobilities in organic materials, the optimized ...

A novel light trapping configuration based on an arrays of micro lenses in conjunction with a self aligned array of micro apertures located in a highly reflecting mirror that ...

Peer A., Biswas R. Nanophotonic organic solar cell architecture for advanced light trapping with dual photonic crystals. ACS Photonics. 2014; ... Inganäs O., Tormen M. Trapping light with micro lenses in thin film organic photovoltaic cells. Opt. Express. 2008; 16:21608-21615. doi: 10.1364/OE.16.021608. [Google Scholar] 25. Dal Zilio S ...

In 2018, Robert L. Z. Hoye et al. [49] demonstrated the first two terminal (2T) perovskite tandem with p-type Si solar cell that enables the voltage addition between p-type Si bottom solar cell and perovskite top solar cell in a 2T tandem structure. Calvin S Fuller from Bell Lab demonstrated the first Si solar cell in 1954 which has a PCE of 8%.

When locating the light trapping element, that displays strong directional asymmetric transmission, in front of thin film organic photovoltaic cells, an increase in cell absorption is ...

We demonstrate a novel light trapping configuration based on an array of micro lenses in conjunction with a self aligned array of micro apertures located in a highly reflecting mirror. When locatin ...

A hybrid of microlens structure and curved surface may produce high value-added micro-optic performance. Hence, the microlens array is proposed on macro curved glass substrate of thin film solar cell.

Extending the insufficient optical path length (OPL) in thin-film photovoltaic cells (PVs) is the key to achieving a high power conversion efficiency (PCE) in devices. Here, we introduce the apparent OPL (AOPL) as a figure of merit for light absorbing capability in thin-film PVs. The optical characteristics such as the structural effects and angular responses in thin ...

We present detailed numerical and experimental investigation of thin-film organic solar cells with a micro-textured light management foil applied on top of the front glass substrate. We first demonstrate that measurements of small-area laboratory solar cells are susceptible to a significant amount of optical losses that

could lead to false interpretation of the measurement ...

In this report, plasmonic effects in organic photovoltaic cells (OPVs) are systematically analyzed using size-controlled silver nanoparticles (AgNPs, diameter: 10 ~ 100 nm), which were ...

Thin film solar cells are one of the important candidates utilized to reduce the cost of photovoltaic production by minimizing the usage of active materials. However, low light absorption due to low absorption coefficient and/or insufficient active layer thickness can limit the performance of thin film solar cells. Increasing the absorption of light that can be converted into electrical ...

Then we highlight recent progress in different types of TPVs, with a particular focus on solution-processed thin-film photovoltaics (PVs), including colloidal quantum dot PVs, metal halide perovskite PVs and organic PVs. ... the common way to enhance transparency is to increase the gap between micro-sized cells or create larger micro-holes ...

Organic photovoltaic (OPV) cells and organic light-emitting diodes (OLEDs) are energy harvesting and generation devices that have attracted great attention ... TVINGSTEDT K, ZILIO S D, INGANÄS O, et al. Trapping light with micro lenses in thin film organic photovoltaic cells [J]. Optics Express, 2008, 16(26): 21608-21615. Article Google Scholar

Trapping light with micro lenses in thin film organic photovoltaic cells. Article. Full-text available. Jan 2009; OPT EXPRESS; ... in front of thin film organic photovoltaic cells, an increase in ...

At present, Building integrated photovoltaic (BIPV) has become a research hotspot in the field of building energy conservation [[1], [2], [3]].And it has been one of the most widely application scenarios of thin film solar cells, because thin film solar cells have excellent power generation performance under low light conditions, and their materials are flexible and light [4, 5].

In recent years, remarkable progress in thin-film photovoltaic cells (PVs) has been made based on novel materials including organic molecules [1-4], quantum-dots [5, 6], and perovskite structured materials [7, 8].Their power conversion efficiencies (PCEs) have already broken the 10% barrier, and even higher PCEs (>20%) are being anticipated as the next ...

Tvingstedt, K., Zilio, S. D., Inganäs, O. & Tormen, M. Trapping light with micro lenses in thin film organic photovoltaic cells. Optics Express 16, 21608-21615 (2008).

To investigate the performance of the proposed thin-film solar cell, we have performed full wave numerical simulation using COMSOL, a commercial numerical solver working based on finite element method. ... Trapping light with micro lenses in thin film organic photovoltaic cells. Opt. Express, 16 (26) (2008), pp. 21608-21615. View in Scopus ...

Micro lenses in thin film organic photovoltaic cells

Thin-film cells are another type of photovoltaic cells made from materials like CdTe, CIGS, and amorphous silicon. The first thin-film solar cell, made from CdTe, was developed by the U.S. government"s National Renewable Energy Laboratory in 1981. 59 Thin-film cells are cheaper to produce and have a lower environmental impact than silicon-based ...

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