Spherical concentrating solar cell

What is a spherical Si solar cell?

The theoretical estimation of an attainable Jsc of a spherical Si solar cell can be obtained from the integration of a reflection over the sphere surface and standard solar energy spectrum as a function of wavelengths. Here, the cell area is defined as the projection area of a sphere.

How do spherical solar cells work?

The spherical solar cells are shown to be able to collect and harvest sunlight three-dimensionally. More specifically,the spherical solar cell acts as a sun-tracking flat cell with the same ground area,and horizontal and vertical flat cells with twice the ground area in terms of the diffuse and reflected beam,respectively.

Can spherical Si solar cells with semi-concentration reflector system perform better?

We have theoretically demonstrated that the spherical Si solar cell with semi-concentration reflector system can realize a performance comparable to that of conventional Si solar cells,with less amount of silicon material use. 1. Introduction

What is JSC of a spherical Si solar cell?

Here,the cell area is defined as the projection area of a sphere. If internal quantum efficiencies in the wavelength range 300-1150 nm are assumed to be unity,Jsc of spherical Si solar cell without anti-reflective coating is calculated to be 26.2 mA/cm 2,while that of a conventional flat Si solar cell with a flat surface is 28.5 mA/cm 2.

Can spherical solar cells capture light three-dimensionally?

Unconventional techniques to benefit from the low-cost and high-efficiency monocrystalline silicon solar cells can lead to new device capabilities and engineering prospects. Here,a nature-inspired spherical solar cell is demonstrated,which is capable of capturing light three-dimensionally.

What is the merit of spherical solar cells?

The average figures of merit [fill factor (FF) = 75.82 ± 0.9%,efficiency (?) = 18.93 ± 0.4%,Voc = 0.644 ± 0.05 V,and Jsc = 38.96 ± 1.1 mA/cm 2]of spherical solar cells are reported where 10 devices are characterized with a small standard deviation (error bar).

Increasing the efficiency of organic solar cells using dielectric spherical nanoparticles Yu.V. Vladimirova1,*, and V.N. Zadkov1,2,3 1International Laser Center and Faculty of Physics, Lomonosov ...

What is Sphelar®? A spherical solar cell is a solar cell in which the surface of a crystalline silicon sphere is a pn junction surface (light receiving surface). It is characterized in that a pair of ...

Herein, a new design is presented where a liquid spherical lens acts as a secondary optical element of the

concentrating solar system, refracting the light beam while participating in spectral beam splitting. The radiation energy unavailable for solar cells is harvested by the liquid spherical lens through spectral beam splitting which serves to raise the ...

Solar concentrator improve the power output of unit area of solar photovoltaic cells with the method of concentrating, to some extent,overcoming the dispersion of solar energy, greatly reducing the cost of power generation with high practical value. Now commonly used condenser method are refraction condenser method (Fresnel lens concentrator) and reflective ...

Geometrical optics is used to devise and study a spherical thick lens for concentrating solar light onto a multilayered photovoltaic cell. It is found that the desired requirement of maintaining the uniformity of the light bundle and the direction normal to the plane of the photovoltaic device can be met. Construction details are specified for a given concentration ratio.

We have theoretically demonstrated that the spherical Si solar cell with semi-concentration reflector system can realize a performance comparable to that of conventional ...

What is Sphelar®? A spherical solar cell is a solar cell in which the surface of a crystalline silicon sphere is a pn junction surface (light receiving surface). It is characterized in that a pair of positive and negative spot electrodes face each other on the center line of the sphere.

A three-dimensional numerical model is presented to simulate spherical p-n junction silicon solar cells, which is a promising new technology for photovoltaic (PV) energy ...

Spherical Si solar cell, which is made up of Si spheres with a diameter of approximately 1.0 mm, is expected to be a promising candidate for low consumption of Si feedstock and simple process ...

Here, a nature-inspired spherical solar cell is demonstrated, which is capable of capturing light three-dimensionally. The proposed cell architecture is based on monocrystalline silicon and is ...

Concentrated photovoltaics (CPV), long a niche technology, has now matured and shown to be reliable enough for large-scale power generation. The employment of high-efficiency triple-junction solar cells with concentrating lenses, particularly in high-temperature settings, provides for steady energy production .

The globe is on the search for environmental energy resources, and solar energy has arisen as a top competitor. Kyosemi a Japanese company has launched a groundbreaking resolution: the Sphelar, a spherical micro solar cell which harnesses sunlight from every direction. Not only does this groundbreaking design improves energy effectiveness but it ...

We have theoretically demonstrated that the spherical Si solar cell with semi-concentration reflector system can realize a performance comparable to that of conventional Si solar cells, with less amount of silicon

material use.

A series of computer experiment in this new solar cell has been made on modeling, optimum design, and performance characterization. In this report, the simulation of spherical silicon solar cell including the concentration light with the concentration mirror is shown. The short circuit current density (Jsc) shows the highest value when the ...

Spherical Si solar cell, which is made up of Si spheres with a diameter of approximately 1.0 mm, is expected to be a promising candidate for low consumption of Si feedstock and simple process technology. This paper describes the formation process and the structure of a concentrator module in detail. The concentrator lens was formed ...

Here, we demonstrate an innovative spherical solar cell design that is capable of harvesting light three-dimensionally by tracking direct sunlight, exploiting diffuse beam, and recycling background reflected light.

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