Design of ultra-thin solar cells

Thick wafer-silicon is the dominant solar cell technology. It is of great interest to develop ultra-thin solar cells that can reduce materials usage, but still achieve acceptable performance and high solar absorption. Accordingly, we developed a highly absorbing ultra-thin crystalline Si based solar cell architecture using periodically patterned front and rear dielectric nanocone ...

We present here a new approach to tandem cell design that offers near-optimum subcell bandgaps, as well as other special advantages related to cell fabrication, operation, and cost reduction. Monolithic, ultra-thin GaInP/GaAs/GaInAs triple-bandgap tandem solar cells use this new approach, which involves inverted epitaxial growth, handle mounting, and parent ...

Incorporating micro-nano structures onto the surface of crystalline silicon (c-Si) solar cells to optimize their light absorption capability and improve photoelectric conversion efficiency is a feasible approach. Here, we propose an ultra-thin c-Si solar cell with a stepped pyramid nanostructure for efficient absorption, which consists of the Ag reflective layer, the c-Si ...

01-04-2023 DESIGN. MIT"s new ultra-thin solar cells can turn almost any surface into a solar panel ... The thin-film solar cells weigh about 100 times less than conventional solar cells while ...

In this work, we report on the device design and numerical simulation results on the characteristics of Cu-doped p-type Bi<inf>2</inf>S<inf>3</inf>-based ultra-thin film solar cells. Potential non-toxic, wide-bandgap n-type semiconductors including ZnS, TiO2, ZnO:Al, and <tex>$mathbf{In}_{2}mathbf{S}_{3}$</tex> were investigated as window layers in this study.

The thin-film solar cells weigh about 100 times less than conventional solar cells while generating about 18 times more power-per-kilogram. Credit: Melanie Gonick, MIT. A team of researchers has developed a ...

Ultra-thin c-Si PV technology can also harvest energy through on-chip embedded solar cells 7 or 3-D integration of solar cells onto chips 8. This extends the usability of IoT sensor chips in harsh ...

Therefore, it is necessary to design ultra-thin PSCs. In this work, we designed an ultra-thin PSC with a thickness of only 700 mm. ... We designed an ultra-thin perovskite solar cell structure with the following layers: FTO/IDL1/RbGeI 3 /IDL2/Au. To make the simulation closer to reality, ...

simulation of an ultra-thin InP solar cell, where the p + and n + regions of the solar cell are replaced by the corresponding hole and electron selective co ntacts, resp ectiv ely.

In this research work, a systematic design of a novel anti-reflective layer using embedded plasmonic nanoparticles is investigated for a thin-film GaAs solar cell. First, an anti ...

Design of ultra-thin solar cells

Here, we now provide a microscopic analysis of PR in ultra-thin absorber solar cells that not only includes the rigorous treatment of spontaneous emission into guided and leaky cavity modes and coupling to surface plasmon polaritons [40, 41] and considers the impact of mirror design on PR beyond the ray-optics limit [42,43,44], but also ...

Nanostructured Si solar cell with all-back-contact design. We achieved high efficiency from ultra-thin, nanostructured Si solar cells by designing an emitter layer at the back of the device rather ...

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Different methods have been utilized to improve ultra-thin-film silicon solar cells, one of which is the proposed plasmonic structure. ... These advantages are used here to design an ultra-thin, high-efficiency silicon solar cell. Figure 8 shows the distribution of an electric field at wavelengths of 400 nm, 500 nm, 700 nm, 900 nm, and 1100 nm ...

Abstract: The polycrystalline ultra-thin cadmium telluride (CdTe) is familiar as the potential solar cell material for its higher efficiency, cost-effective, cell stability and clean generation of solar ...

Thin-film technology has made it possible to produce low-cost solar cells. This is mainly due to plasma-assisted chemical vapor deposition technology that enables the production of thin-film solar cells by growing ...

We design buffers that provide (1) high reflectivity over a narrow bandwidth, for quantum well solar cells, (2) reflectivity over a wide bandwidth, for optically thin solar cells, and (3) low ...

The demand for cheaper and more efficient solar cells is the main reason behind the ongoing research on ultra-thin solar cells. In this research work, the electric field generated by the surface ...

This article demonstrates a significant enhancement in the efficiency of an ultra-thin film perovskite solar cell. This has been achieved through the combination of a single-step grating (SSG) structure with metal nanoparticles. To investigate this phenomenon, a comparison is conducted between the proposed structure and plasmonic flat solar cell, by evaluating ...

Design of an efficient ultra-thin film Cu (In, Ga) Se2 solar cell, using plasmonic cluster back reflectors Sol. Energy, 261 (2023 Sep 1), pp. 1 - 6 View PDF View article View in Scopus Google Scholar

Semantic Scholar extracted view of "Design of an ultra-thin silicon solar cell using Localized Surface Plasmonic effects of embedded paired nanoparticles" by Abolfazl Jangjoy et al. Skip to search form Skip to main content Skip to account menu. Semantic Scholar"s Logo. Search 222,040,941 papers from all fields of science ...

Design of ultra-thin solar cells

To design an ideal ultra-thin silicon solar cell, its absorption spectra need to be manipulated in a wide range of the solar spectrum. To achieve this objective, various types of nanoparticles are used in this paper. As seen in Fig. 1, using paired nanoparticles inside the active layer is our main strategy. Here, the cell is assumed as a p-n ...

Ultra-thin (& lt; 100 nm absorber thickness) GaAs cells are a promising avenue for the design of solar cells with increased radiation tolerance for space applications. To address the high transmission loss through such thin absorber layers, rigorous coupled-wave analysis and a semi-analytical waveguide model are used to investigate the effectiveness of silver/dielectric ...

Thin-film technology has made it possible to produce low-cost solar cells. This is mainly due to plasma-assisted chemical vapor deposition technology that enables the production of thin-film solar cells by growing silicon (Si) layers [] instead of stacking silicon wafers pared with the cost-intensive poly-crystalline Si wafer cutting method where thick ...

This paper presents a modeling study of an ultra-thin CIGS-based solar cell with a 0.5-micron-thick absorber layer, using Silvaco Atlas software. The CIGS solar cell module incorporates three buffer layers made of ZnS, CdS, and ZnSe. Notably, our study distinguishes itself by utilizing an ultra-thin 0.5-micron absorber layer, a substantial departure from the ...

The conversion efficiency of thin film silicon solar cell is still much below that of wafer silicon solar cell due to low optical absorption. ... Nano-Photonic Structures for Light Trapping in Ultra-Thin Crystalline Silicon Solar Cells. 2017 o ... "Design of plasmonic thin-film solar cells with broadband absorption enhancements." Adv ...

However, current epitaxial III-V solar cells are very expensive and cannot compete for the terrestrial market, and therefore, researchers are developing alternative growth methods such as thin ...

MIT researchers developed a scalable fabrication technique to produce ultrathin, flexible, durable, lightweight solar cells that can be stuck to any surface. Glued to high-strength fabric, the solar cells are only one ...

Our simulated results show that embedded nanoparticles significantly improve the photocurrent of an ultra-thin silicon solar cell. This approach and obtained results are ...

CIGS thin-film solar technology: Understanding the basics A brief history... CIGS solar panel technology can trace its origin back to 1953 when Hahn made the first CuInSe 2 (CIS) thin-film solar cell, which was nominated as a PV material in 1974 by Bell Laboratories. In that year, researchers began to test it, and by 1976 University researchers made the first p ...

In this work, using plasmonic cluster nanostructure, an effective back reflector was designed to improve the

performance of ultra-thin film CIGS solar cell. Shapes, sizes, ...

The highest i = 19.01% was achieved for the designed ultra-thin bandgap-graded CIGS solar cell decorated by Au nanoparticles. The objective of this study is to enhance the efficiency of copper indium gallium selenide (CIGS) solar cells. ... Columbus D, (2014) "Design and optimization of copper indium gallium selenide solar cells for ...

CIGS thin-film solar technology: Understanding the basics A brief history... CIGS solar panel technology can trace its origin back to 1953 when Hahn made the first CuInSe 2 (CIS) thin-film solar cell, which was ...

Perovskite solar cells have emerged as a promising third-generation solar cell technology, characterized by high efficiency and low fabrication costs, garnering significant research attention in recent years. In this study, the impact of embedding the cluster of cubic plasmonic nanoparticles within the ultra-thin absorber layer of perovskite solar cells was ...

The demand for cheaper and more efficient solar cells is the main reason behind the ongoing research on ultra-thin solar cells. In this research work, the electric field generated by the surface plasmons effects has been used to design an ultra-thin silicon solar cell.The main idea of this work is the use of paired nanoparticles with both the same and ...

Although heat dissipation has a significant influence on the performance and reliability of solar cells, there is little research on it. An extended three-dimensional simulation of the thermal behaviour of Sn-based perovskite solar cells (PSCs) without a hole transport layer is presented for the first time. The primary purpose of this work is to simulate transient operating ...

DOI: 10.1016/j.apmt.2020.100720 Corpus ID: 225309053; Design of wave-optical structured substrates for ultra-thin perovskite solar cells @article{Haque2020DesignOW, title={Design of wave-optical structured substrates for ultra-thin perovskite solar cells}, author={Sirazul Haque and Miguel F. Alexandre and Manuel J. Mendes and Hugo {"A}guas and Elvira Fortunato and ...

The polycrystalline ultra-thin cadmium telluride (CdTe) is familiar as the potential solar cell material for its higher efficiency, cost-effective, cell stability and clean generation of solar electricity. In this study, a numerical analysis has been performed utilizing AMPS (Analysis of Microelectronic and Photonic Structures) simulator to examine the cell performances (V <sub ...

Ultrathin solar cells with thicknesses at least 10 times lower than conventional solar cells could have the unique potential to efficiently convert solar energy into electricity ...

Design of ultra-thin solar cells