Absorption spectrum of solar cells

How do device layers affect light absorption across the solar spectrum?

Using a full-wave simulation approach, we report for the first time the contributions of each device layers in light absorptions across the whole solar spectrum. It is found that perovskite layer dominants the absorption in UV and visible bands, while the electrode layers dominants the IR bands.

Why do solar cells have different spectra?

The main reason for the difference in efficiency and other important parameters of the solar cell,using two different spectra,is the difference in the generation rate of electron-holein this layer. In other layers,rate of the generation and recombination are similar,and in FTO the amount of recombination is close to zero.

What is a realistic absorption spectrum?

A realistic absorption spectrum shows a peak in a certain wavelength (energy) range and variation in the entire range. This feature is well reproduced in the DFT-spectrum however,it is not reflected in the analytical spectrum implemented in the SCAPS. Another major difference to be mentioned is the absorption magnitude in the shorter wavelengths.

Why is optical absorption spectrum important?

Optical absorption spectrum provides essential information on the electronic structure of semiconductorsand plays an important role in simulation studies of solar cells as well . Zhu et al. applied quasiparticle corrections via GW approach to achieve realistic DFT description of the orthorhombic and tetragonal MAPbI 3.

Does plasmonics improve the absorption of a thin film solar cell?

Atwater and Polman (2010) emphasized that plasmonics improves the absorptionand reduces the physical thickness of absorber layer for thin film solar cell. Chang et al. (2014) extended this field to perovskite solar cell and found that plasmonic particles accelerate the exciton generation in the perovskite layer.

How does the thickness of a solar cell affect recombination?

By increasing the thickness of the absorber,higher portion of photons are absorbed,which would lead to an increase in the performance of the solar cell. On the other hand,as the thickness of the absorber increases,the recombination of the electron-hole pairs increasesas well,which negatively affects the function of the solar cell.

3 ???· The results show the possibility of increasing the efficiency of solar cells by increasing the light absorption inside the active Si layer from ?60% to ?80%. Future perspectives on the proposed method and its possible applications are discussed. In this study, the light propagation in a structure consisting of SiOx on Si substrate with Al nanoparticles regularly placed in the ...

Perovskite-based solar cells have recently been catapulted to the cutting edge of thin-film photovoltaic research and development because of their promise for high-power conversion efficiencies and ease of fabrication. Two types of generic perovskites compounds have been used in cell fabrication: either Pb- or Sn-based. Here, we describe the performance ...

Using narrow bandgap nonfullerene acceptors (NFAs) can broaden the absorption spectrum of organic solar cells (OSCs) to the near-infrared region. However, the simultaneously decreased extinction coefficient of the active layer at the blue region results in inevitable light escaping and energy loss. Herein, a blazed grating-based device configuration ...

2 ???· This study investigates the impact of CuO (p-type) incorporation into TiO2 (n-type) photoanodes, sensitized with three different natural dyes extracted from scarlet eggplant, pitomba, and black grape fruits using ethanol, for dye sensitized solar cells (DSSCs). The natural dyes visible light absorption properties were characterized through ultraviolet-visible (UV-Vis) ...

We report in this work that quantum efficiency can be significantly enhanced in an ultra-thin silicon solar cell coated by a fractal-like pattern of silver nano cuboids. When sunlight shines this ...

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In this work, we focus on a new role of the InAs nipi superlattice layer as the absorption unit in solar cell structures, with the intended aim for applications in space at very low temperatures. Meanwhile, the introduction of ...

Perovskite solar cells (PSCs) have shown high optical absorption and consequently provide high conversion efficiency with stable performance. In our work, CH3NH3PbI3 (MAPbI3) as an absorber layer is analyzed for different crystalline structures. Cubic, tetragonal, and orthorhombic phases of perovskite material are investigated to check the ...

As illustrative examples of our optimized inverted pyramid PhC solar cells, we show two absorption spectra in Fig. 4 over the 300-1200 nm wavelength range: a thin cell with H = 5 um and a ...

We report in this work that quantum efficiency can be significantly enhanced in an ultra-thin silicon solar cell coated by a fractal-like pattern of silver nano cuboids. When sunlight shines this solar cell, multiple antireflection bands are achieved mainly due to the self-similarity in the fractal-like structure. Actually, several kinds of ...

Perovskite solar cells are used in silicon-based tandem solar cells due to their tunable band gap, high absorption coefficient and low preparation cost. However, the relatively large optical refractive index of bottom silicon, in comparison with that of top perovskite absorber layers, results in significant reflection losses in two-terminal devices. Therefore, light ...

The band gap can be determined from absorption-reflection or ellipsometry measurements and a Tauc plot [17, 18] or from the inflection point of the quantum efficiency spectrum of the solar cell . Since the Shockley-Queisser model assumes complete absorption above the band gap, equation (5) is valid independent of a direct or indirect band gap.

By mixing BSOC and YAG phosphors, the hybrid materials will have broader absorption spectral characteristics suitable for silicon solar cells. In this work, BSOC ...

In this paper, we investigate a way to improve the performance of thin films CIGS-based solar cells by optimizing their spectral responses. Band gap profile grading, aroused this last decade as a very promising strategy to achieve higher efficiency.

We report implementation of optical absorption spectrum obtained from DFT calculations to study the performance of solar cells with MAPbI 3, MAPbBr 3, and MAPbCl 3 ...

Theoretical analysis of the absorption spectrum, electronic structure, excitation, and intramolecular electron transfer of D-A?-?-A porphyrin dyes for dye-sensitized solar cells +. A series of porphyrin dyes with ...

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