Dielectric metamaterial solar cells

Can metamaterials be used in solar cells?
Insertion of metamaterials in solar cells seems to be one of the interesting approachesowing to the promising properties of these news materials. Metamaterials are a class of man-made subwavelength structured composite materials. Metamaterials with their unusual electromagnetic properties allow unprecedented guiding of the incident light.

What are dielectric metamaterials?
Compared to metallic metamaterials, dielectric metamaterials are more promising, as they do not heat under exposure to electromagnetic radiation, which minimizes their energy dispersion. Every dielectric metamaterial can even be used in the optical spectrum to control its resonance.

Can a dielectric metamaterial control its resonance?
Every dielectric metamaterial can even be used in the optical spectrum to control its resonance. The research team's work demonstrates a promising new direction in the development of metamaterials.

Can a new metamaterial be used in Silicon Nanooptics and solar cells?
The scientists suggest that this new metamaterial can be used in silicon nanooptics and solar cells. Work on the experimental part of the study is currently continuing with RAS and international partners.

Can a metamaterial-dielectric be used to make optical devices?
A research team from the NUST MISIS Laboratory of Superconducting Metamaterials led by Alexey Basharin,Senior Lecturer and Candidate of Technical Sciences,has developed a metamaterial-dielectric that has unique characteristics and is easy to manufacture. This ease of access will allow researchers to use it to create the latest optical devices.

Why are new photoelectrical techniques developed for silicon solar cells?
The reduction of the significant optical lossesdue to the reflection and the increase of the penetration of the solar photons into the silicon initiated the development of new photoelectrical techniques for silicon solar cells.

This paper proposes a metamaterial absorber design for solar energy harvesting using a simplified and symmetric structure. A unit cell of this design consists of three important ...

In this paper, we undertake a numerical study of the optical response of a multilayer planar waveguide structure based on metamaterials for silicon solar cells. The ...

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A new light trapping technique that exploits dielectric core-shell optical antennas to strongly enhance solar absorption and holds promise for cost reduction and efficiency improvement of solar conversion devices, including solar cells and solar-to-fuel systems.

Compared to metallic metamaterials, dielectric metamaterials are more promising as they do not heat under exposure to electromagnetic radiation, which minimizes ...

Proposed an all-dielectric metamaterial design scheme for reducing light reflection, which can effectively avoid light loss in devices such as thermal photovoltaic systems and significantly ...

Compared to metallic metamaterials, dielectric metamaterials are more promising as they do not heat under exposure to electromagnetic radiation, which minimizes their energy dispersion. Every dielectric metamaterial can even be used in the optical spectrum to control its resonance.

Abstract: in this work the perfect absorption characteristics of a tungsten (W) based hexagonal resonator based metamaterial absorber for solar cell applications was investigated. The paper shows the maximum absorption of the solar cell created by using Silicon and Gallium Arsenide (GaAs) material. The proposed metamaterial absorber has the potential to improve the ...

Herein, we propose a dual-dielectric-layer metamaterial selective absorber (DDMSA) that achieves near-perfect absorption in the entire solar spectrum while having low thermal radiation in the mid-infrared region. The proposed DDMSA can achieve strong absorption with an absorbance of above 90% over a wide spectrum from ultraviolet to ...

This report systematically demonstrated the plasmonic and localized surface plasmon resonance (LSPR) effect in the perovskite solar cells (PSCs) using MAPbI3 as an active layer. The finite element method (FEM) was employed for the entire simulation of PSCs. Various light trapping and smooth charge carrier dynamics geometries with tailored nanoparticles ...

A step-wise methodology showcasing the nanofabrication of dielectric metamaterial coatings using electron-beam lithography to engrain light-absorptive patterns onto Titanium-Dioxide films, which ...

A new light trapping technique that exploits dielectric core-shell optical antennas to strongly enhance solar absorption and holds promise for cost reduction and efficiency improvement of ...

Graphene and carbon nanotube were used as active materials in solar cell absorbers. Rufangura et al. (2017) designed a metamaterial (MM) absorber with a graphene monolayer sheet located on top of ...

One typical design for metamaterial absorbers is the sandwiched dielectric between two metal layers. The top and bottom surfaces are usually composed of plasmonic metals, such as aluminum (Al), silver (Ag), and gold

(Au), while the center layer is usually a lossy dielectric. These days, plasmonic nanostructured absorbers are also made from a variety of ...

Using electron-beam lithography, dielectric metamaterials can be programmed to have different resonances at specific wavelengths in the solar spectrum, covering every electromagnetic wave we...

This paper proposes a metamaterial absorber design for solar energy harvesting using a simplified and symmetric structure. A unit cell of this design consists of three important layers namely, the bottom metallic layer, which is gold lossy, the intermediate layer: made of a lossy dielectric material that is gallium arsenide and patches which ...

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