Nanoantennas for nanowire photovoltaics

We consider the use of plasmonic nanoantenna elements, hemispherical and cylindrical, for application in semiconductor nanowire (NW) vertical arrays. Using Mie theory and a finite element method, scattering and ...

After introducing basic concepts of nanowire synthesis, we discuss important aspects of nanowire design for high power conversion efficiencies; first in terms of light absorption, then in terms of charge carrier separation and collection. ... Photovoltaics Report, Updat. 6 June 2016 (2016)... A. Polman et al. Science (2016) N.S. Lewis. Science ...

Abstract: We investigate photovoltaics incorporating standing nanowire arrays of silicon using a full wave finite element computational approach. The interaction of sunlight with bare nanowires and also with nanowires attached to dielectric nanoantennas are studied. We compute the absorption spectra in each case and compare the results to determine a possible ...

DOI: 10.1021/acs.nanolett.9b04873 Corpus ID: 216645917; Hot-carrier extraction in nanowire-nanoantenna photovoltaic devices. @article{Chen2020HotcarrierEI, title={Hot-carrier extraction in nanowire-nanoantenna photovoltaic devices.}, author={I-Ju Chen and Steven Limpert and Wondwosen Metaferia and Claes Thelander and Lars Samuelson and Federico Capasso ...

Alisafaee, MA Fiddy, "Nanoantennas for nanowire photovoltaics" Applied Physics Letters 105 (11), 113107 Alisafaee, J Marmon, MA Fiddy, "Spectral properties of Au-ZnTe plasmonic nanorods" Photonics Research 2 (1), 10-14

High performance deep-subwavelength lateral GaAs nanowire solar cells decorated with Au nanoblocks are proposed and studied through coupled three-dimensional optoelectronic simulations. The results show that Au nanoblocks significantly improve the absorption for TE polarized light mainly due to the excitation of localized surface plasmon. Surface local and ...

Based on the device structures, the absorption efficiency along the nanowire axis before and after the nanoantennas were added was simulated with the FDTD methods. The results show that ...

Request PDF | Photovoltaics with dielectric nanoantennas | We investigate photovoltaics incorporating standing nanowire arrays of silicon using a full wave finite element computational approach.

Optimizing Photovoltaic Charge Generation of Nanowire Arrays: A Simple Semi-Analytic arXiv:1412.5224v1 [physics.optics] 16 Dec 2014 Approach Björn C. P. Sturmberg,*,+ Kokou B. Dossou,? Lindsay C. Botten,? Ara A. Asatryan,? ...

Nanoantennas for nanowire photovoltaics

1 Hot-carrier extraction in nanowire-nanoantenna photovoltaic devices I-Ju Chen1, Steven Limpert1, Wondwosen Metaferia1,2, Claes Thelander1, Lars Samuelson1, Federico Capasso3, Adam M. Burke1, Heiner Linke1 1NanoLund and Solid State Physics, Lund University, Box 118, SE-22100 Lund, Sweden 2National Renewable Energy Laboratory, Golden, CO 80401, United ...

It has been demonstrated recently that a nanowire (NW) of high refractive index dielectric materials works as a nanoantenna because of the excitation of the Mie-type resonances. Here, we explore the capability of a silicon (Si) NW as an optical nanoantenna by combining it with an external metallic component. We investigate the light scattering property of a single Si NW ...

Improving Nanowire Photovoltaics In principle, solar cells based on arrays of nanowires made from compound inorganic semiconductors, such as indium phosphide (InP), should decrease materials and ...

In this letter, we combine plasmonic nanoantennas with InAs-InP-InAs nanowire devices to enhance light absorption within a subwavelength region near an InP energy barrier that serves ...

Fig. 1 presents a model of nanowire with an optical bowtie nanoantenna that was used in our numerical simulations. The NW"s material is silicon and the bulk dielectric permittivity e used in the calculations is obtained from experiment [8].The equilateral nanoprisms are set to be made of gold with e also taken from Palik [8].The NW"s length (l) is 500 nm and is constant ...

This approach allows us to image the local density of optical states (LDOS) of Al nanorod antennas with a spatial resolution less than 20 nm and to identify the radiative modes of these nanostructures across the visible and into the UV spectral range. The use of aluminum for plasmonic nanostructures opens up new possibilities, such as access to short-wavelength ...

Photovoltaic (PV) cells can serve as a virtually unlimited clean source of energy by converting sunlight into electrical power. Their importance is reflected in the tireless efforts that have been ...

Microbial protein nanowires are emerging as an alternative to abiotic nanowires for electronics applications. Microbial nanowires are sustainably produced, robust, non-toxic, biodegradable and ...

Hybrid nanoantennas. Studies of plasmonic nanoantennas suggest a high level of their dissipation losses, especially when the distance between metallic nanoelements is smaller than their characteristic size. In this case, strongly dissipative higher-order plasmon modes are excited in a system of interacting metallic nanoparticles.

This review article surveys the potential of using plasmonic nanostructures to enhance the absorption of photovoltaic devices. As a result, the physical thickness of solar cells can be reduced ...

Nanoantennas for nanowire photovoltaics

In this Letter, we combine plasmonic nanoantennas with InAs-InP-InAs nanowire devices to enhance light absorption within a subwavelength region near an InP energy barrier that serves ...

Intermediate band solar cells (IBSCs) are conceptual and promising for next generation high efficiency photovoltaic devices, whereas, IB impact on the cell performance is still marginal due to the ...

Silicon Nanowire on Mirror Nanoantennas -Engineering Hybrid Gap Mode for Light Sources and Sensing Platforms ... are good candidates for new optoelectronic or photovoltaic devices due to their ...

Nanoantennas for nanowire photovoltaics. Appl. Phys. Lett. (September 2014) Strong nonlinear optical response from ZnO by coupled and lattice-matched nanoantennas. J. Appl. Phys. (May 2019) Directive and enhanced spontaneous emission using shifted cubes nanoantenna. J. Appl. Phys. (September 2016)

We consider the use of plasmonic nanoantenna elements, hemispherical and cylindrical, for application in semiconductor nanowire (NW) vertical arrays. Using Mie theory and a finite element method, scattering and absorption efficiencies are obtained for the desired enhancement of interaction with light in the NWs. We find an optimal mixture of nanoantennae for efficient ...

It is known that the periodic use of silver nanoantennas in organic solar cells increases the efficiency of light absorption. In this study, we performed a geometric parametric analysis of ...

Semiconductor nanowires(NWs) with subwavelength scale diameters have demonstrated superior light trapping features, which unravel a new pathway for low cost and high efficiency future generation ...

Solar energy, as a renewable, clean, and widespread energy, is widely studied because it can be transformed into other energies for wide applications such as solar cells [1,2,3], photovoltaic devices [4, 5], and photo-thermal emitters [6, 7].Since Landy et al. reported the perfect absorbers based on the metal-insulator-metal triple-layer meta-materials [], a plenty of ...

We experimentally investigate the optical properties of layers of InP, Si, and GaP nanowires, relevant for applications in solar cells. The nanowires are strongly photonic, resulting in a significant coupling mismatch with incident light due to multiple scattering. We identify a design principle for the effective suppression of reflective losses, based on the ratio of the nondiffusive ...

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Optimizing Photovoltaic Charge Generation of Nanowire Arrays: A Simple Semi-Analytic

Nanoantennas for nanowire photovoltaics

arXiv:1412.5224v1 [physics.optics] 16 Dec 2014 Approach Björn C. P. Sturmberg,*,+ Kokou B. Dossou,? Lindsay C. Botten,? Ara A. Asatryan,? Christopher G. Poulton,? Ross C. McPhedran,+ and C. Martijn de Sterke+ University of Sydney, and ...

Semiconductor nanowires are promising for photovoltaic applications1,2,3,4,5,6,7,8,9,10,11, but, so far, nanowire-based solar cells have had lower efficiencies than planar cells made from the same ...

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