Iii-v nanowire photovoltaics review of design for high efficiency

What are free-standing nanowires based on III-V compound semiconductors?
Free-standing nanowires based on III-V compound semiconductors have attracted considerable research interests in recent years due to their potential applications to novel nanophotonic devices,such as nano-lasers ,photo-detectors [21,22,23],and efficient nanowire array solar cells .

Can nitride III-V nanowires be synthesised by bottom-up synthesis?
This paper deals with dilute nitride III-V (III-N-V) semiconductor nanowires and their synthesis by bottom-up (so-called self-assembly) methods for application to novel and high efficiency intermediate-band solar cells (IBSCs).

Can MOVPE technology grow III-N-V nanowires?
Limited studiesexist however,for the growth of III-N-V nanowires by MOVPE technology. For both technologies much remains to be done however,to obtain device-quality nanowires,while in-situ doping of III-N-V alloys within the nanowires remains largely unexplored.

How does vapor composition affect axially-modulated nanowire heterostructures?
Changing of the vapor composition/doping during the VLS process allows for the growthof axially-modulated nanowire heterostructures; in particular,tunable and high doping levels is demonstrated for III-V nanowires grown by the method .

Are nanowire IBSCs based on dilute nitride III-V?
The fabrication of nanowire IBSCs based on dilute nitride III-Vs,such as the core-multishell structures proposed in Fig. 6,depends critically on the ability of MBE and MOVPE technologies to precisely self-assemble them.

Which self-assembly methods are used for synthesis of III-V nanowire heterostructures?
Three major self-assembly methods are currently employed for the synthesis of III-V nanowire heterostructures: (i) metal-catalyst assisted growth,(ii) self-catalyzed growth and (iii) selective-area epitaxy (SAE).

Growing high-quality and low-cost GaAs nanowires (NWs) as well as fabricating high-performance NW solar cells by facile means is an important development towards the cost-effective next-generation photovoltaics. In this work, highly crystalline, dense, and long GaAs NWs are successfully synthesized using a two-source method on non-crystalline SiO2 ...

Solar energy is abundant, clean, and renewable, making it an ideal energy source. Solar cells are a good option to harvest this energy. However, it is difficult to balance the cost and efficiency of traditional thin-film solar

cells, whereas nanowires (NW) are far superior in making high-efficiency low-cost solar cells. Therefore, the NW solar cell has attracted great attention in recent years ...

Supporting: 1, Mentioning: 173 - 1 Introduction Global energy demand is predicted to exceed 30 TW by 2050, about double the present value [1]. This predicament, known as the TeraWatt challenge, and concern over anthropogenic climate change, resource availability ("peak energy") and energy security have all increased the interest in renewable energy (hydroelectric, wind, ...

In this paper, we report the electrical simulation results of a proposed GaInP nanowire (NW)/Si two-junction solar cell. The NW physical dimensions are determined for optimized solar energy absorption and current matching between each subcell. Two key factors (minority carrier lifetime, surface recombination velocity) affecting power conversion efficiency ...

This paper deals with dilute nitride III-V (III-N-V) semiconductor nanowires and their synthesis by bottom-up (so-called self-assembly) methods for application to novel and high efficiency intermediate-band solar cells (IBSCs). Nanowire-IBSCs based on III-N-V compounds promise to overcome many of the limitations encountered so far in quantum-dots or planar ...

High efficiency III-V nanowire solar cell: III-V nanowire-based photovoltaics (PV) are a promising replacement for thin-film solar cells, offering the potential for less material utilization, excellent anti-reflection properties, lattice-mismatched growth on silicon, and high power conversion efficiency. In the Review@RRL article by LaPierre et al. (pp. 815-830), the ...

III-V semiconductor nanowires have gained intensive attention for solar cell applications due to their unique geometrical, optical, and electrical properties, as well as improved accessibility to a wider range of alloy compositions (and thus tunable bandgaps) and substrates (such as Si), which allows further exploration and implementation of various tandem solar cell designs to broaden ...

LaPierre RR, Chia ACE, Gibson SJ et al (2013) III-V nanowire photovoltaics: review of design for high efficiency. Phys Status Solidi RRL 7:815-830. Article Google Scholar Lunt RR, Osedach TP, Brown PR et al (2011) Practical roadmap and limits to nanostructured photovoltaics. Adv Mater 23:5712-5727

III-V nanowires (NWs) have been envisioned as nanoscale materials for next-generation technology with good functionality, superior performance, high integration ability and low cost, because of their special growth modes and unique 1D structure. In this review, we summarize the main challenges and important progress of the fabrication and applications of III-V NWs. We ...

Download: Download full-size image Figure 1. Increase of the highest reported efficiencies of III-V multijunction concentrator solar cells. Data is based on the "Solar Cell Efficiency Tables," in which record efficiencies have regularly been published since 1993 [1].The latest edition considered here is Ref. [2].

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followed by important aspects of single nanowire fabrication and design consideration for high power conversion efficiencies (PCEs) in terms of light absorption and charge carrier separation and collection. ... footprint. Therefore, to complement the comprehensive reviews on III-V nanowire array solar cells,[1] ... trapping and high-efficiency ...

III-V nanowire photovoltaics: Review of design for high efficiency," ... Search ADS 13. G. Otnes. and . M. T. Borgström, " Towards high efficiency nanowire solar cells," ... Optical design of GaN nanowire arrays for photocatalytic applications. J. Appl. Phys. (May 2018)

III-V nanowire photovoltaics: Review of design for high efficiency," ... High-efficiency nanowire solar cells with omnidirectionally enhanced absorption due to self-aligned indium-tin-oxide Mie scatterers," ... Design of light scattering in ...

Semiconductor III-V nanowire arrays have taken a vital part in the development and growth of very high-performance LEDs and photovoltaic devices. As per our understanding till now, we would say the first footstep toward the fabrication of nanodevices is the exponential growth of nanostructures on a plane/substrate.

Photovoltaics (PVs) based on nanostructured III/V semiconductors can potentially reduce the material usage and increase the light-to-electricity conversion efficiency, which are anticipated to make a significant impact on the next ...

III-V nanowire photovoltaics: Review of design for high efficiency ... accommodation, design for high efficiency, tunnel junctions, Ohmic contact formation, passivation and doping. Perform-ance data of III-V nanowire cells and the primary challenges in ...

High efficiency III-V nanowire solar cell: III-V nanowire-based photovoltaics (PV) are a promising replacement for thin-film solar cells, offering the potential for less material utilization, excellent anti-reflection properties, lattice-mismatched growth on silicon, and high power conversion efficiency. In the Review@RRL article by LaPierre et al. (pp. 815-830), the status of nanowire ...

Stable devices with active area efficiency as high as ~ 11% were demonstrated in GaAs substrates. Recent work in two-junction III-V and Si nanowire solar cells suggest an efficiency as high as 28.15% is possible (Wang et al., 2015). This shows that indeed the concept of using known high-efficiency PV materials in a novel nano- or ...

Single GaAs nanowire photovoltaic devices were fabricated utilizing rectifying junctions in the Au-Ga catalytic tip/nanowire contact interface. Current-voltage measurements were performed under simulated Air

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Mass 1.5 global illumination with the best performance delivering an overall energy conversion efficiency of ~2.8% for a nanowire of 70 nm in ...

Photovoltaics (PVs) based on nanostructured III/V semiconductors can potentially reduce the material usage and increase the light-to-electricity conversion efficiency, which are anticipated to make a significant impact on the next-generation solar cells. In particular, GaAs nanowire (NW) is one of the most promising III/V nanomaterials for PVs due to its ideal bandgap and excellent ...

The results depict the usefulness of integrating NWs to construct high-efficiency multi-junction III-V solar cells and two key factors affecting power conversion efficiency of the solar cell are highlighted. In this paper, we report the electrical simulation results of a proposed GaInP nanowire (NW)/Si two-junction solar cell. The NW physical dimensions are determined ...

By transitioning away from bulk semiconductor thin films or wafers, high efficiency photovoltaic cells comprised of III-V NWs grown on Si would improve performance and take advantage of cheaper materials, larger wafer sizes, and improved economies of scale associated with the mature Si industry.

State-of-the-art III-V multijunction cells have achieved a record efficiency of 42.8%, which has fueled great interest in the utility sector for large-scale deployment. However, III-V solar cells have thus far proven too expensive for ...

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