

Advances in Silicon-based High-Efficiency Light-Efficient Technology



Overview

In this article, we review the most recent advances in light sources integrated onto mainstream Si platforms and discuss four different integration technologies: Group IV light sources on Si, heterogeneous integration of III-V light sources on Si, blanket. In this article, we review the most recent advances in light sources integrated onto mainstream Si platforms and discuss four different integration technologies: Group IV light sources on Si, heterogeneous integration of III-V light sources on Si, blanket. The primary challenge in silicon photonics is achieving efficient luminescence in the communication band, crucial for its large-scale application. Despite significant efforts, silicon light sources still suffer from low efficiency and limited emission wavelengths. We addressed this by achieving. Silicon-based on-chip light sources are important since they can provide a compact solution for various applications in the field of high-speed optical communications, high-precision sensing, quantum information processing, and so on. Several important breakthroughs were made in this field in the past few years. One of the main strategies to overcome the limitations of silicon for light emission.



Article Content

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Advances in optoelectronics for environmental and energy

It explores how advancements in photovoltaic technologies, including silicon-based, thin-film, and perovskite solar cells, are improving solar energy conversion efficiency through innovations

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Review of status developments of high-efficiency crystalline silicon ...

The efficiency records of the above high efficiency crystalline silicon solar cells are shown in table 1 and the reported efficiency of crystalline silicon solar cells with the years (2011–2017) for

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Realizing efficient on-chip light sources has long been the ‘holy-grail’ for Si-photonics research. Several important

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Silicon-based optoelectronics: progress towards large

Silicon-based optoelectronics has become the key technology to break through these bottlenecks. Thanks to the advantages of high refractive

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Silicon solar cells with hybrid back contacts

Silicon solar cells with hybrid interdigitated back contacts have a power conversion efficiency approaching 95% of the theoretical limit and a fill factor approaching 98% of the theoretical

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Latest advances in high-performance light sources and optical ...

Abstract: Efficient light generation and amplification has long been missing on the silicon platform due to its well-known indirect bandgap nature. Driven by the size, weight, power and cost (SWaP-C)

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Despite significant efforts, silicon light sources still suffer from low efficiency and limited emission wavelengths.

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We start with briefly introducing the basic concepts of each technology and then focus on the recent progress via presenting the most representative

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We report on the fabrication and performances of highly efficient Si-based light sources. The devices consist of MOS structures with erbium (Er) implanted in the thin gate oxide. They exhibit

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The primary challenge in silicon photonics is achieving efficient luminescence in the communication band, crucial for its large-scale application. Despite significant efforts, silicon light

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Abstract — The power semiconductor industry is driven by the increasing demand for efficient, clean and sustainable energy solutions which

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Silicon-Based On-Chip Light Sources: A Review

We review the progress of silicon-based on-chip light sources in various materials. We provide some key parameters like pump thresholds, output powers, and pump schemes of on-chip

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The laser-induced localized crystallization technology and the in-situ edge passivation technology developed by the team offer advantages

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High-efficiency electroluminescence devices containing Si

Here, we report an electroluminescence device based on phosphorus (P)-doped silicon nanocrystals (Si NCs)/silicon carbide (SiC) multilayers by modulating carrier injection and

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On-chip light sources for silicon photonics

Here, we briefly review the history and recent progress of a few promising contenders for on-chip light sources in terms of operating wavelength, pump condition, power consumption, and...

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A review of technologies for high efficiency silicon solar cells

To overcome these problems, many techniques have been investigated. This paper presents an overview of high-efficiency silicon solar cells's typical technologies, including surface passivation,

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Efficient silicon based light emitters

Recent progress on electrically driven silicon based light emitters is reviewed, with emphasis on our work on light emitting pn diodes (LED) and MOS devices doped with rare-earth

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Silicon-based optoelectronics: progress towards large

Advances in conventional inorganic photoactive materials, such as silicon and III-V compound semiconductors, enabled the development of high

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Recent Advances in Homogeneous Integration of Emitting ...

This paper presents a comprehensive review of existing approaches for homogeneous integration of light sources on a silicon platform. Future research should focus on optimising these

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Extreme high efficiency enabled by silicon carbide (SiC) power devices

Efficient renewable electricity generation, conversion, and delivery are vital for addressing the pressing need to limit global temperature rise to below 2 °C by 2050. The

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Silicon-Based On-Chip Light Sources: A Review

Silicon-based on-chip light sources are important since they can provide a compact solution for various applications in the field of high-speed

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Recent advances in light sources on silicon

Recent advances in light sources on silicon Yu Han,^{1,5}Hyundai Park,²John Bowers,³ AND Kei May Lau^{4,6} ¹State Key Laboratory of Optoelectronic Materials and Technologies, School of Electronics

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High-Efficiency Crystalline Silicon Solar Cells: Status and

towards higher efficiencies. Next, we discuss two archetypal high-efficiency cell architectures, namely interdigitated-back-contact and silicon heterojunction solar cells.

May 29, 2026

Slow-light silicon modulator with 110-GHz bandwidth

By comprehensively balancing a series of merits, the modulators can benefit from the slow light for better efficiency and compact size while remaining

Sep 14, 2025

Recent Developments in Si-based Materials and Devices

Under the Research Topic “ Recent Developments in Silicon-Based Materials and Devices ” we have compiled a total of seven articles covering the recent advances in the design of Si

Oct 31, 2025

High-efficiency silicon light emitting diodes

There has been enormous interest in the development of efficient silicon light emitting diodes (LEDs), since this could allow “superintegration” of optical and electronic functions in high

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