Practical and Commercially Viable Silicon-Photonic Systems

Tech ID: 27119 / UC Case 2016-912-0

BACKGROUND

Silicon photonics have wide applicability that includes data center interconnects, high-performance computing, space-based communications, and sensing. However, the development of silicon-photonic integrated circuits has been limited by a number of factors. The high cost of compound-semiconductor substrates as compared to silicon-based substrates, as well as the incurrence of extra processing steps and processing complexity associated with the integration, has restricted the desirability, scalability, and commercial success of conventional approaches for integrating compound semiconductor devices and silicon-based integrated-optics substrates. As a result, there remains a need for a simple, low-cost approach to integrating compound-semiconductor devices and silicon-based integrated-optic substrates to form practical, commercially viable silicon-photonics systems.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a low-cost, scalable approach to integrate compound-semiconductor lasers directly onto silicon-photonic circuits for efficient, commercially viable photonic systems. This technology provides a method to epitaxially grow quantum-dot compound-semiconductor lasers on silicon-on-insulator (SOI) substrates with surface waveguides. By directly depositing active optical devices on indirect-bandgap silicon substrates, the invention reduces cost and complexity compared to traditional heterogeneous or hybrid integration methods. This approach facilitates efficient optical coupling of the laser sources to silicon-based waveguides and supports scalable manufacturing of silicon-photonic integrated circuits, empowering applications in data communications, sensing, and high-performance computing.

ADVANTAGES

- Significant cost reduction over conventional compound-semiconductor substrate methods
- Lower threshold currents enabling more efficient laser operation
- Improved temperature stability of lasing threshold
- Enhanced device longevity with longer lifetimes
- Highly scalable and compatible with existing silicon processing infrastructure

APPLICATIONS

- Silicon-photonic integrated circuits for data center interconnects and telecommunications
- High-performance computing optical links
- Sensing technologies leveraging integrated photonics

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OTHER INFORMATION

KEYWORDS

Semiconductors, Photonics, Lasers, indadvmat

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Communications**
  - Optical
- **Semiconductors**
  - Other

RELATED CASES

2016-912-0

- Space-based and other advanced communication systems
- Optical components combining microelectronics and photonics for complex signal processing

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,761,266	09/01/2020	2016-912

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Bonding of Heterogeneous Material for Improved Yield and Performance of Photonic Integrated Circuits
- Integrated Reconfigurable Circulator
- Magneto-Optic Modulator
- Quantum Dot Photonic Integrated Circuits
- Integrated Dielectric Waveguide and Semiconductor Layer
- Orthogonal Mode Laser Gyro
- Monolithically Integrated Laser-Nonlinear Photonic Devices
- Misfit Dislocation Free Quantum Dot Lasers

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