



## Bonding of Heterogeneous Material for Improved Yield and Performance of Photonic Integrated Circuits

Tech ID: 30044 / UC Case 2014-312-0

### BRIEF DESCRIPTION

A new approach to photonic integrated circuit fabrication.

### BACKGROUND

Cost is a fundamental design criterion for data centers looking for a technological solution for the transition between centers dominated by high speed copper connections and those with optical connections. Silicon photonics fabrication technology is reaching the point where it can offer superior performance and similar lifecycle costs to current technologies. One challenge to silicon photonic fabrication is the mismatch that occurs when III-V materials are grown on native III-V substrates then transferred to silicon substrates using the wafer bonding process. This mismatch can result in increased defects and degradation of material quality and device efficiency.

### DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a new method of photonic integrated circuit fabrication where quantum dot III-V material and silicon waveguides are both grown on silicon substrates and are bonded using the wafer bonding process. Using identical substrates overcomes many of the limitations associated with substrate dissimilarity and also enables further processing of the III-V material before and/or after the wafer bonding. The process also shows potential for scalable, high-yield production of photonic integrated circuits.

### ADVANTAGES

- ▶ Improved integrity of device
- ▶ Scalable wafer size
- ▶ No CTE mismatch of substrates

### APPLICATIONS

- ▶ Optoelectronic devices
- ▶ Semiconductor lasers

### PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,360,623	06/07/2016	2014-312

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### OTHER INFORMATION

#### KEYWORDS

indadvmat, photonic integrated circuit, advanced materials, silicon photonics fabrication, quantum dot III-V, silicon waveguides, wafer bonding process

#### CATEGORIZED AS

- ▶ **Optics and Photonics**
  - ▶ All Optics and Photonics
- ▶ **Materials & Chemicals**
  - ▶ Other
- ▶ **Nanotechnology**
  - ▶ Electronics
  - ▶ Materials
- ▶ **Semiconductors**
  - ▶ Materials
  - ▶ Other

#### RELATED CASES

2014-312-0

## ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Epitaxial Laser Integration on Silicon Based Substrates
- ▶ A Hybrid Silicon Laser-Quantum Well Intermixing Wafer Bonded Integration Platform
- ▶ Integrated Reconfigurable Circulator
- ▶ Magneto-Optic Modulator
- ▶ Quantum Dot Photonic Integrated Circuits
- ▶ Ring Resonator-Based Optical Isolator and Circulator
- ▶ Integrated Dielectric Waveguide and Semiconductor Layer
- ▶ Orthogonal Mode Laser Gyro
- ▶ Loss Modulated Silicon Evanescent Lasers
- ▶ Monolithically Integrated Laser-Nonlinear Photonic Devices
- ▶ Misfit Dislocation Free Quantum Dot Lasers

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