



Vertical Cavity Light Sources Based on Stacked Membranes

[View U.S. Patent No. 8,217,410 in PDF format.](#)

WARF: P08398US

Inventors: Zhenqiang Ma, Weidong Zhou

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing vertical cavity light-emitting sources based on stacked membranes.

Overview

Improvements in technologies such as cell phones, laptops and small digital electronics are the result of the increasing capability of electronics and photonics. However, there is a continuing need for improved interconnectivity between the “photonics domain” and the “electronics domain” in multifunctional photonic/electronic systems. Mismatched physical scaling between photonic components and electronic components creates difficulties in high-density integration of photonics and silicon-compatible optoelectronics, or electronics that control and detect light.

Vertical cavity light-emitting sources can be wafer-scale fabricated in high-density 2-D arrays, and have low diffraction output beams that allow efficient coupling. Therefore, vertical cavity light-emitting sources, including light-emitting diodes and lasers, could be ideal compact light sources for large-scale silicon-based photonics if they could be directly built on a silicon wafer. However, conventional vertical cavity light-emitting source technology utilizes thick reflector mirrors, which limit device performance and integration density. A need exists for a practical silicon-integrated light source that is highly efficient, ultra-compact, electrically controllable, complementary metal-oxide-semiconductor (CMOS) process-compatible and reliable.

The Invention

UW–Madison researchers in collaboration with researchers at the University of Texas at Arlington have developed a system and method to fabricate vertical cavity light-emitting sources that utilize patterned membranes as reflectors. The vertical cavity light-emitting sources have a stacked structure that includes an active region placed between an upper reflector and a lower reflector. The active region and upper and lower reflectors can be fabricated from single or multilayered thin films of solid state materials or membranes, which can be processed separately and stacked to form a vertical cavity light-emitting source. As a result, the vertical cavity light-emitting sources can be compact, with thickness smaller than 3 μm .

The use of patterned membranes as reflectors makes it possible to eliminate thick mirror reflectors from the vertical cavity light-emitting source structure, which facilitates high-density array fabrication on a single substrate. In addition, by tailoring the structural parameters of the patterned membranes, different vertical cavity light-emitting sources in an array can be tailored to produce different output radiation wavelengths from ultraviolet through far-infrared.

Applications

We use cookies on this site to enhance your experience and improve our marketing efforts. By continuing to browse without changing your browser settings to block or delete

- High-resolution, re cookies, you agree to the storing of cookies and related technologies on your device. [See our privacy policy.](#)
- Low cost photo transceivers for wavelength conversion, imaging and sensing

OK



Key Benefits

- Allows fabrication of vertical cavity light-emitting sources on substrates not typically considered compatible
- Enables heterogeneous integration with a variety of substrates, including silicon wafers
- Eliminates the lattice-mismatch concern between photonic and electronic domains
- Minimizes surface state impact from the reflector/active region interfaces by placing electrical contacts between the active region and reflectors
- May be tailored to emit output radiation across a range of wavelengths

Stage of Development

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones. WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- [Zhenqiang Ma](#)

Related Intellectual Property

- [View Continuation Patent in PDF format.](#)

Tech Fields

- [Semiconductors & Integrated Circuits : Design & fabrication](#)

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846

We use cookies on this site to enhance your experience and improve our marketing efforts. By continuing to browse without changing your browser settings to block or delete cookies, you agree to the storing of cookies and related technologies on your device. [See our privacy policy.](#)

OK



WARF
Wisconsin Alumni Research Foundation

| info@warf.org | 608.960.9850