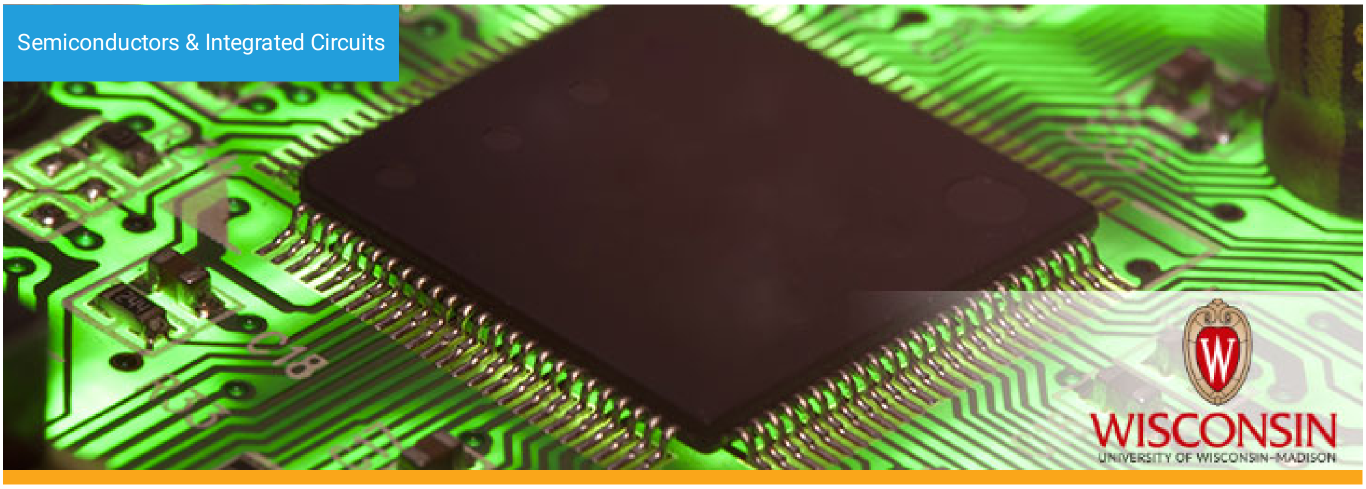
Semiconductors & Integrated Circuits



All-Glass Optical Microresonator for Single Molecule Spectroscopy and More

View U.S. Patent No. 9,678,276 in PDF format.

WARF: P150382US01

Inventors: Randall Goldsmith, Kassandra Knapper, Kevin Heylman

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an improved optical microresonator platform with superior biocompatibility and performance.

Overview

Label-free sensing methods could enable detection and characterization of chemical species at the single molecule level without the aid of probes or modifications to the target of interest. Such capability would have powerful implications in medical diagnostics, toxicology and chemical quantification.

Whispering gallery mode (WGM) optical microresonators have been shown to be a highly effective platform for label-free sensing, reaching the single protein and single nucleotide level, and enabling label-free imaging of non-emissive particles. Of all the different shapes of WGM microresonators, microtoroidal resonators has shown the highest levels of sensitivity, including reaching the single molecule limit. This success derives from two main properties: high quality (Q) factor and low mode volume (V). In addition, microtoroidal resonators have the advantage of on-chip fabrication, a critical requirement for large-scale production and reduced complexity.

UW–Madison researchers recently developed ultrahigh-Q factor microtoroidal resonators useful in spectroscopy and optical processing (see WARF reference numbers P140153US01 and P140153US03). Their glass-on-silicon design resulted in many improvements, but silicon is known to disrupt some biological processes and can cause unwanted background absorption, limiting its utility. They continue to seek improvements in design and performance, and have now found a novel way to address this limitation.

The Invention

Building on their previous work, the researchers have developed all-glass microtoroidal resonators with improved sensitivity (i.e., superior Q/V ratio). Unlike their SiO_2 on Si counterparts, the new resonators can be made chip scale – a significant advantage. Moreover, the use of glass in place of silicon makes the platform more desirable for applications including label-free sensing due to optical transparency in the visible region. Additionally, glass is a robust, chemically inert material and more biocompatible than silicon.

The new fabrication method follows the same general scheme as the previously developed oxide-on-silicon toroids, but the materials are inverted. This results in a silicon toroid atop an oxide pillar, followed by thermal oxidation to form an all-glass structure in the final step.

Applications

- Improved optical microresonator platforms for label-free sensing, single particle/molecule microscopy and spectroscopy, photonics technologies (optical processing, filtering, signaling, etc.), microfluidics and more

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

Key Benefits

- Can be made chip scale
- Superior biocompatibility, versatility and performance
- Improved Q/V ratio
- Addresses design and analysis challenges of silicon
- Fabrication methods are fully scalable, high throughput and uniform.

Stage of Development

The new methods have been used to fabricate glass-on-glass, high-Q factor microtoroidal resonators.

Additional Information

For More Information About the Inventors

- Randall Goldsmith

Related Technologies

- See WARF reference number P140153US01 for information about the researchers' method for laser tuning optical microcavities.
- See WARF reference number P140153US03 for information about the researchers' microcavity method for single molecule spectroscopy.

Tech Fields

- Analytical Instrumentation, Methods & Materials : Microscopy
- Semiconductors & Integrated Circuits : Other semiconductor technologies

For current licensing status, please contact Justin Anderson at janderson@warf.org or 608-960-9853

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