Ultra-High-Q Surface-Tension-Induced Monolithically Integrated On-Chip Resonator and Associated Devices
Technology #11855

Applications

- Optical biosensors, switches, filters and attenuators
- Chalcogenide Glass Mid-IR Laser

Problem Addressed

Optical resonators enhance light-matter interactions, thereby dramatically improving the performance of optical devices. A leading resonator, the surface-tension-induced microcavity (STIM) resonator, is currently an off-chip application, exhibiting poor optical coupling and incompatibility with requisite fabrication processes. Partially on-chip designs exhibit vulnerability to environmental changes, require very precise alignment, and also lack robust optical coupling.

Technology

The invention proposes a fully on-chip resonator with effective coupling to achieve a robust, highly reproducible design suitable for industrial scale applications. The fully on-chip ultra-high-Q resonator device is fabricated with selected glass and polymer materials such as chalcogenides and methods including the thermal reflow technique to achieve an ultra-high-Q-factor. An optical coupling scheme allows for full control of the coupling regime between the on-chip STIM and the optical resonator, the coupling strength, and the resonator's quality factor. CMOS-compatibility is maintained and this highly reproducible device is readily integrated into applications such as lasers and biosensors.

Advantages

- Fully on-chip design maintains CMOS-compatibility, improving system robustness
- Optical resonator coupling suitable for industrial scale applications
- Select materials achieve robust design with ultra-high-Q-factor performance

Categories For This Invention:

- Photonics
- Other (Photonics)
- Sensors (Photonics)
- Biosensors

Intellectual Property:

Ultra-High-Q Surface-Tension-Induced monolithically integrated on-chip resonator and associated devices
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Publications:

On-Chip Optical Isolation in Monolithically Integrated Non-Reciprocal Optical Resonators
Nature Photonics

Monolithic Integration of Chalcogenide Glass/Iron Garnet Waveguides and Resonators for On-Chip Nonreciprocal Photonic Devices
Jan. 17, 2011

Planar Waveguide-Coupled, High-Index-Contrast, High-Q Resonators in Chalcogenide Glass for Sensing
Optics Letters

Ultra-High-Q Toroid Microcavity on a Chip
Nature Materials

Optical Loss Reduction In High-Index-Contrast Chalcogenide Glass Waveguides Via Thermal Reflow
OPTICS EXPRESS
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