INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

High Q-factor Microring Resonators via Damascene Soft Nanoimprinting

TECHNOLOGY NUMBER: 2024-170

OVERVIEW

Affordable, high-quality microring resonators using damascene soft nanoimprinting

- Eliminates residual layers, increasing Q-factor and reducing fabrication defects
- Used in biosensing, optical filters, photonics, and quantum information processing

BACKGROUND

Microring resonators are fundamental components in optical technology, often employed in varied domains like biosensing and quantum information. Historically, achieving high-quality microring resonators involved E-beam lithography, a high-cost and low-throughput process characterized by intricate equipment requirements and compatibility limitations with diverse materials. Nanoimprint lithography emerged as an alternative due to its potential for high-throughput fabrication, but it commonly leaves residual layers around the waveguides, causing unwanted radiation losses and impacting the performance. Consequently, the path to fabricating high Q-factor resonators has been fraught with challenges involving cost-efficiency and defect management. Therefore, there is a critical need for an innovative fabrication method that can surmount these barriers, combining affordability, simplicity, and quality to enhance optical device performance.

INNOVATION

Researchers at the University of Michigan have developed, damascene soft nanoimprinting lithography (DsNIL), a novel process to achieve high Q-factor microring resonators. By focusing on patterning the waveguide cladding layer through UV soft NIL, this approach circumvents the high-pressure, high-temperature demands typical of other techniques. The subsequent backfilling of imprinted trenches with high-index polymers results in a deficit of residual layers, a common impediment in traditional methods, thus minimizing radiation loss. This innovation simultaneously improves reproducibility, reduces costs, and enables fabrication in ordinary lab settings without specialized tools. Real-world applications encompass integrated photonic circuits and sensors, leveraging the technology's capacity for flexible substrates and low-defect production, with potential widespread use in fields such as quantum computing and medical diagnostics.

ADDITIONAL INFORMATION

REFERENCES

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Hardware
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