



# 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.

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## Category

Hardware

Engineering & Physical Sciences

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## View online page



## **ADDITIONAL INFORMATION**

### **REFERENCES**

High Q-Factor Polymer Microring Resonators Realized by Versatile Damascene Soft Nanoimprinting Lithography, Wei-Kuan Lin, Shuai Liu, Sungho Lee, Zhesheng Zhang, Xueding Wang, Guan Xu, L. Jay Guo, <https://doi.org/10.1002/adfm.202312229>

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