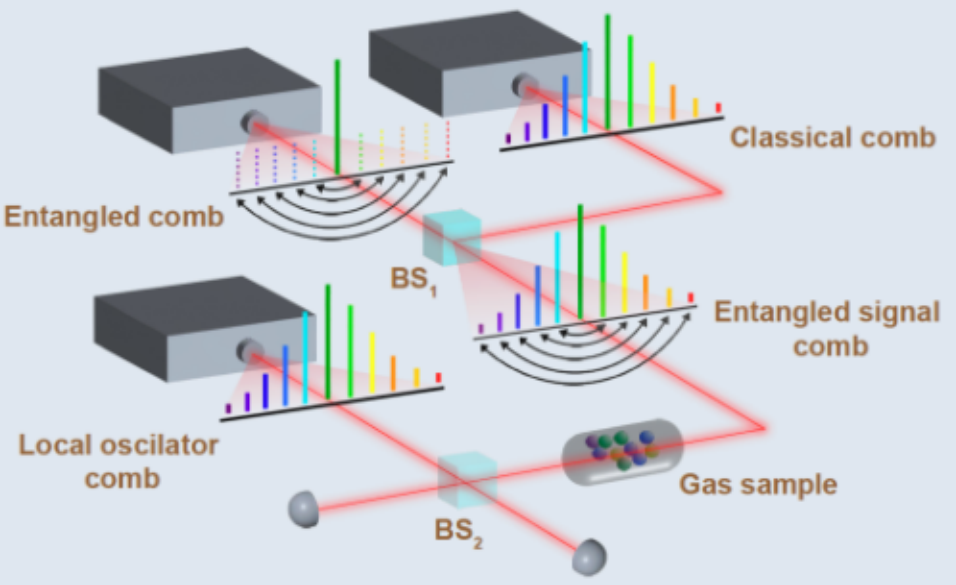
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Integrated Quantum Photonics Platform for Precision Sensing and Navigation

TECHNOLOGY NUMBERS: 2024-520, 2025-293

Accelerate Blue Foundry - 2025 (Physical Sciences)



OVERVIEW

This technology is a robust wafer-scale process for ultra-low-loss, high-Q silicon nitride photonic integrated circuits. By preventing stress-induced cracking in thick silicon nitride, this technology enables scalable, reliable, high-performance photonic chip production for quantum and classical photonics, metrology, spectroscopy, quantum communication, remote sensing, radar systems.

DESCRIPTION

The technology harnesses a proprietary wafer-scale fabrication method that produces crack-free, ultra-low-loss silicon nitride photonic chips using a unique amorphous silicon hardmask. This process enables manufacturing of thick, defect-free, and high-performance optical components previously unattainable at scale—an essential foundation for the practical deployment of advanced frequency comb instruments. A demonstrator created by this process, EDCS (Entangled Dual-Comb Spectroscopy) chip exploits quantum entanglement across the comb's frequencies, enabling simultaneous, below-noise-threshold measurements at unprecedented speed and sensitivity. The integrated solution, all CMOS-compatible and scalable, unlocks new classes of real-time, high-throughput measurement tools that transcend the limitations of traditional optical and spectroscopic instrumentation.

Technology ID
2025-293

Category
Hardware
Engineering & Physical Sciences
Accelerate Blue Foundry - 2025/Physical Sciences

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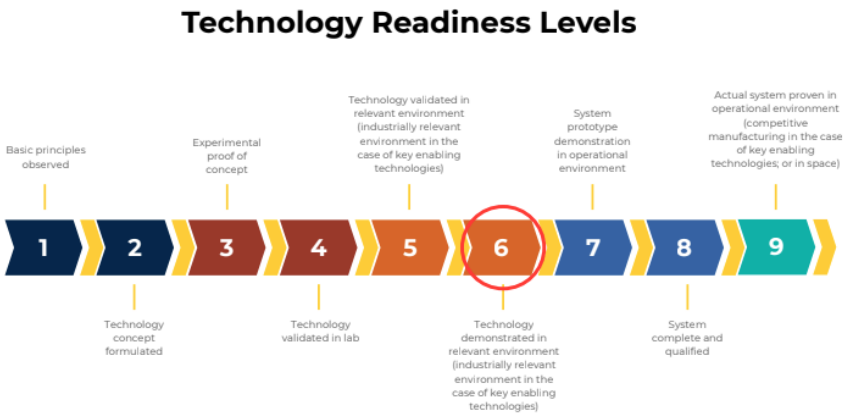
VALUE PROPOSITION

- First scalable method for producing crack-free, high-performance silicon nitride photonic hardware essential for quantum-enabled dual-comb spectroscopy.
- Enables the only demonstrated, practical, and manufacturable platform for simultaneous ultra-fast, ultra-sensitive, and low-noise measurement across broad frequency ranges.
- Manufacturable using standard semiconductor (CMOS) processes, supporting cost-effective, high-volume deployment in mission-critical sensing and measurement systems.

TECHNOLOGY READINESS LEVEL



INTELLECTUAL PROPERTY STATUS

Patent application pending.

MARKET OPPORTUNITY

There is surging demand for high-Q, low-loss photonic integrated circuits in quantum computing, precision timing, environmental sensing, and next-generation telecommunications. Current technologies are stymied by film stress, cracking, and insufficient process scalability, with many solutions requiring complex, costly, or unreliable fabrication steps. This invention addresses an underserved need for a robust, reproducible, and scalable process compatible with mainstream silicon photonics manufacturing. Key application markets—quantum and classical communications, LiDAR, integrated metrology, and broadband spectroscopy—are poised for rapid growth. By enabling wafer-scale volume production of high-Q photonics, this technology positions adopters at the forefront of photonic and quantum hardware markets, supporting the evolution of miniaturized, high-performance, and low-cost optical systems.