

Silicon nitride photonics platforms with extremely low propagation loss

Imec offers SiN integrated photonics in different flavors: low-loss SiN (based on LPCVD technology), CMOS-compatible SiN (based on PECVD technology) and co-integrated Si/SiN platform where imec's advanced SiP platform is enriched with an extra layer of SiN waveguides. Whether for research or product development, these technologies are accessible from early prototyping up to volume manufacturing, for a broad range of applications: communication, computing (quantum, AI), advance light sources (low linewidth, high power, MLL), biophotonics (sensing), optical beamforming (lidar, laser communication over air) and gas sensing.

TECHNOLOGIES

Low-loss SiN platform

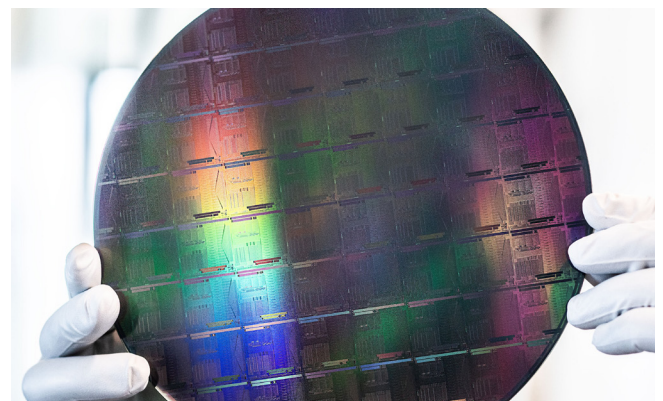
- Based on low-pressure chemical-vapor deposition (LPCVD)
- Extremely low-loss waveguide (<0.1 dB down to 2 dB/m)
- Tight process control on 200mm wafer (~ 1 nm over 200mm wafer)
- High-power handling (watt-range)
- Wide wavelength transparency (405 nm up to 2500 nm)
- Library of passive components: grating couplers, splitters, ring resonators, directional couplers, ...

CMOS-compatible SiN platform

- Based on plasma-enhanced chemical-vapor deposition (PECVD)
- Compatible with CMOS wafer process (imager, driver)
- Undetectable auto-fluorescence (bio-spectrometer)
- High-power handling (watt-range)
- Wide wavelength range (405 nm up to 2500 nm)
- Low-loss waveguide (<2 dB/cm)

Co-integrated Si/SiN platform

- Integration of SiN into established imec SiP technology and layer stack optimization towards your application
- Custom integration on CMOS
- Low-loss interface access for InP wafer scale (laser, RSOA) hybrid integration



A silicon-nitride wafer with photonics integrated circuits manufactured on imec's advanced 200mm line.

APPLICATIONS

Communication

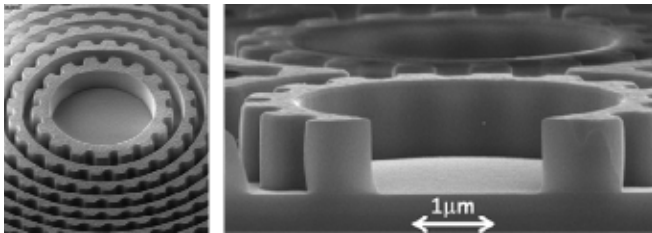
A silicon nitride platform with distinct features such as tight process control (1-nm thickness control over full 200-mm wafer), CMOS compatibility, low propagation loss, and high-power handling is the perfect environment for developing devices in the communication domain, such as thermally less sensitive filter/multiplexers or interposer.

Optical computing (Quantum, AI)

Optical computing and specifically quantum photonics is characterized by extremely low-loss circuitry and a high level of integration. Imec's SiN platform is very suited for this a.o. because of low phase noise and low propagation losses of 0.3 dB/cm down to a few dB/m and low interface coupling loss.

Advance light sources

Many applications require integrated high-performance laser sources. Imec technologies can be used for advance mode-locked lasers with both high and low repetition rates, tunable low-linewidth lasers, multi-wavelength visible laser sources and high-power/low-noise single-mode lasers. Low repetition, low noise MLL laser is already demonstrated by imec team using this technology.



Fresnel phase plate lenses (FPPL) (PECVD)

Biophotonics

Imec's low autofluorescence and stable SiN platform enables the development of extremely sensitive, low-cost and disposable solutions for sensing and bio-photonic applications in industries such as food sorting, medical tools and life sciences domain.

Beamforming

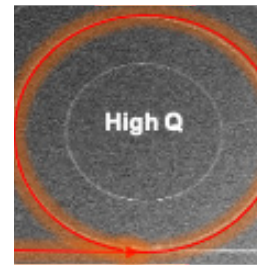
Applications such as autonomous vehicles, robotic and 5G need an optical beamforming network to non-mechanically steer, shape and focus light. Thanks to its low loss and high-power handling, the silicon nitride platform is ideal to accomplish this.

Gas sensing

Most gases show strong absorption peaks in the infrared wavelength range. Imec's waveguide-opening process, wide spectrum range (400-2000nm and beyond) and high thermal tolerance are key for these applications.



Extremely low loss SiN rib waveguide.



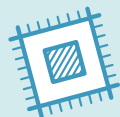
High quality factor SiN ring resonator, (LPCVD).

THE IMEC ROUTE

SHORTER TIME-TO-MARKET



Concept



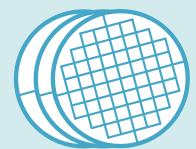
Design & simulation



Technology development



Prototyping & engineering



Low & high-volume production

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