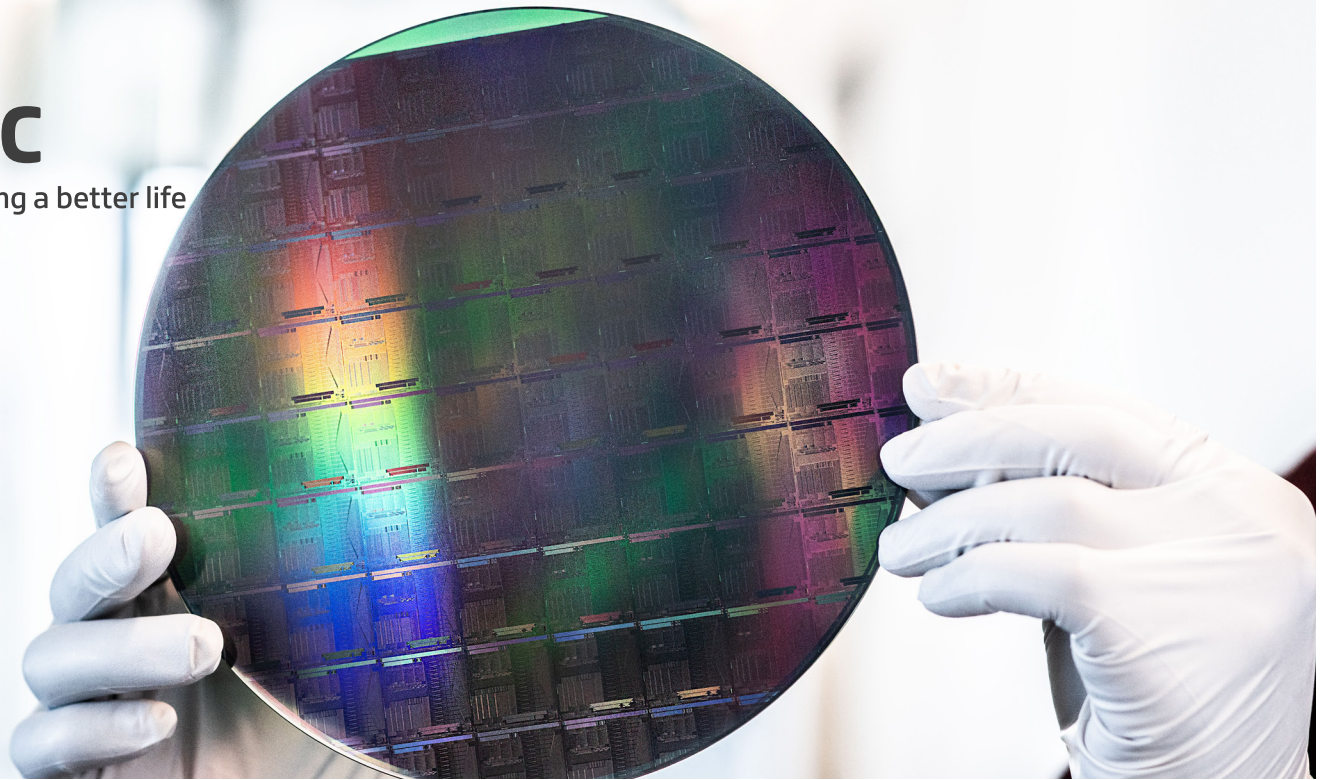




embracing a better life



# Silicon nitride photonics platforms with extremely low propagation loss

Imec offers SiN integrated photonics in different flavors: low-loss SiN (based on LPCVD technology) and CMOS-compatible SiN (based on PECVD technology). 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) biophotonics (sensing), AR/VR/MR and industrial sensing.

## TECHNOLOGIES

### Low-loss SiN platform

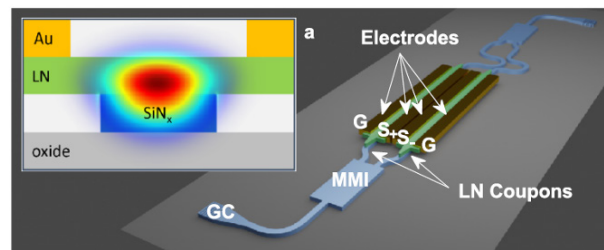
- Based on low-pressure chemical-vapor deposition (LPCVD)
- Extremely low-loss waveguide (below 2 dB/m for core SiN waveguide)
- Tight process control on 200mm wafer (~1 nm over 200mm wafer)
- High-power handling (watt-range)
- Wide wavelength transparency (405 nm up to 2500 nm)
- Range of passive components: 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)
- Wide wavelength range (405 nm up to 2500 nm)
- Low-loss waveguide (<2 dB/cm)
- Post processing compatible with 10 nm OVL

## Active integration development

- Light source (MLL, dualcomb, RSOA, VCSEL, ...)
- Electro-optic materials (LNO, BTO, ...)
- Detector
- CMOS chip integration
- Compatible with micro transfer printing



Active integration: thin film LiNbO on SiN



Examples of fine patterning of optical components e.g. grating, waveguides and taper

## APPLICATIONS

### Communication

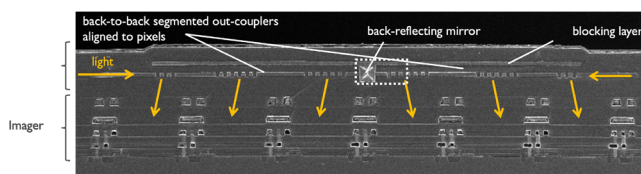
A silicon nitride platform with distinct features such as tight process control (1-nm thickness control over full 200-mm wafer), CMOS compatibility, low propagation loss, and high-power handling is the perfect environment for developing devices in the communication domain, such as thermally less sensitive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

### Biophotonics

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



Co-integration of SiN photonics with CMOS wafers

### Industrial sensing

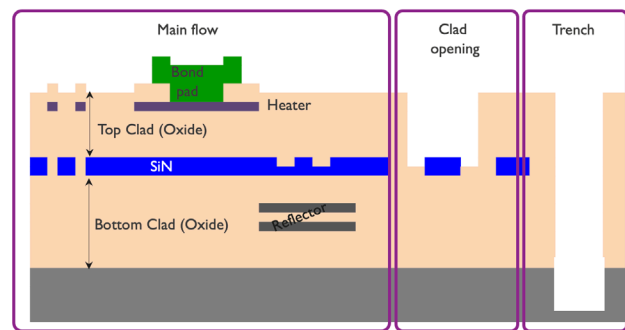
Most gases show strong absorption peaks in the infrared wavelength range. Imec's waveguide-opening process, wide spectrum range (400-2000nm and beyond) and high thermal tolerance are key for these applications.

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### AR/VR/MR

Processing of photonic circuit on glass substrate, NIL technology and RGB light engine on the SiN and new waveguide materials will be the best way to scale down the modules formfactor and reduce their production cost in volume.



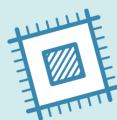
SiN photonic Platform flavors

## THE IMEC ROUTE

SHORTER TIME-TO-MARKET



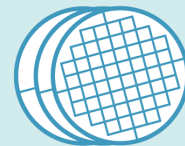
Concept



Design & simulation



Prototyping



Low & high-volume production

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