

MID-INFRARED PIC

MID-IR PHOTONIC INTEGRATED CIRCUITS PROTOTYPING SERVICE

+ LETI'S GERMANIUM PLATFORMS

Leti has developed proprietary technological platforms dedicated to Mid-IR—photonic integrated circuits (PIC) using germanium or germanium alloys with a 3 μm -12 μm wavelength range:

- The first platform uses **Si₆₀Ge₄₀ alloy as core material with a Si cladding**. It provides passive optical functions, from simple straight waveguides to junctions, crosses, resonators, Mach-Zehnder interferometers and combiners—Arrayed Waveguides Gratings—for any wavelength ranging from 3-8 μm .
- The second platform is based on **Ge core with SiGe cladding**. This technology helps address a broader 3-11 μm wavelength range and provide a full palette of components.

+ APPLICATIONS

Both platforms are mainly dedicated to mid-IR spectroscopy and sensing in gas and liquid environment. Combined with Mid-IR light absorption or photoacoustic detection, these technologies help achieve highly miniaturized multi-gas sensors.

+ WHAT'S NEW?

Leti offers a platform for the fabrication of low loss waveguides, covering the whole mid-IR wavelength 3-11 μm and a large palette of functional components.

These technologies are made on silicon substrate, and they are suitable for further technological steps allowing the integration of other functions.

Leti has recently developed in his CMOS facilities a quantum cascade laser on silicon by structuring the III-V stack directly bonded on 200 mm-wafer. It paves the way toward a massive adoption of QCL-based sensing through a drastic fabrication cost reduction.

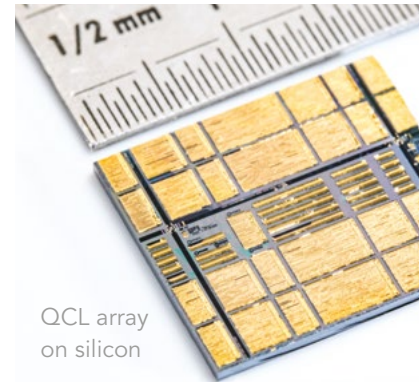
KEY FIGURES

- SiGe waveguides exhibit a propagation loss of 0.3 dB/cm @ 4.5 μm . Typical AWG combiner with 35 inputs covers a 2185-2285 cm^{-1} range (2.5 cm^{-1} step) with a cross-talk less than -12 dB and an insertion loss of -1.6 dB.
- Ge waveguides exhibit a propagation loss of 3.5 dB/cm @ 8 μm . Typical AWG combiner with 67 inputs covers 1050 cm^{-1} -1250 cm^{-1} with 3 cm^{-1} step.

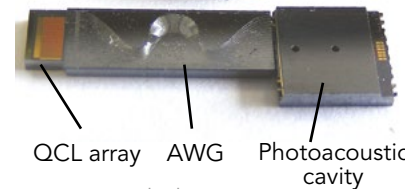
+ WHAT'S NEXT?

To combine passive components with laser sources, several approaches are under development. Goal is to achieve a complete integrated spectroscopic system using IR-detector or photoacoustic sensor.

Implementing a convergence between the two above technological platforms for passive and active devices is the next step toward a fully integrated Mid-IR photonics devices.



QCL array
on silicon



QCL array AWG Photoacoustic
cavity
Butt-coupled
spectroscopic gas sensor

INTERESTED IN THIS TECHNOLOGY?

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