The photoacoustic spectroscopy technique is based on the absorption of light by the molecules of interest and the subsequent generation of acoustic waves. This technique, typically used for high-resolution mid-IR spectroscopy, is today confined to laboratory applications due to its size and cost.

Leti proposes µPAsense, a compact photoacoustic sensor working in the mid-infrared region, by assembling a multi-wavelength quantum cascade laser (QCL) source with a photonics integrated circuit (PIC) combiner in a small photoacoustic cell (a few cm³). This sensor allows multigas detection with very high sensitivity down to a few ppb level.

Trace gas detection and sensing in:

- Environmental
- Process control
- Quality assurance
- Safety & security
- Early disease diagnosis
Leti’s teams are focusing on miniaturization of the sensor at chip or packaging level to address cost reduction, multigas detection and portability.

Key achievements toward miniaturization are:
- The effective fabrication process for QCL sources (originally developed by our startup partner mirSense): the wavelength of each laser is selected independently after the growth of the epitaxial layers
- Low-loss waveguides based on Ge and SiGe alloy to realize the PIC combiner (losses as low as <1dB/cm on the 3-12 µm range)
- Mini acoustic Helmholtz detectors fabricated on silicon and based on MEMS microphones suitable for trace-gas detection

mirSense, a Leti’s startup company, is currently industrializing and commercializing this mini photoacoustic gas sensor.

WHAT’S NEXT?

Leti currently is working on:
- Transfer of the QCL fabrication process on silicon wafer
- Realization of the photoacoustic detector on silicon
- New designs of the photoacoustic cell to improve resolution and stability
- Ozone detection in the UV band

INTERESTED IN THIS TECHNOLOGY?

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