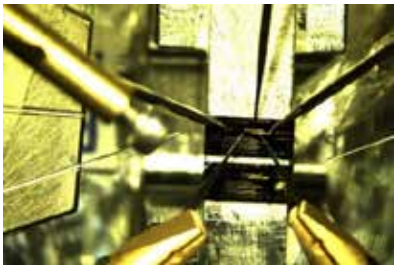
Centre for Applied Photonics

Monitor greenhouse gases

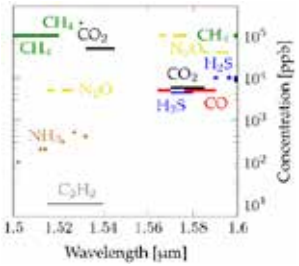
Emission monitoring with Photonic Integrated Circuit gas sensors

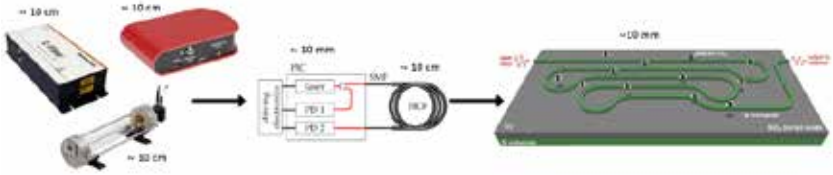
Agriculture and lifestock farming are major sources for greenhouse gases. In a green society, emissions need to be monitored.



AU setup to verify PIC performance.

Several relevant gases can be detected using PIC technology





A spectroscopy setup consists of laser source, interaction cell, and detector. Free-space components are bulky. Integrating these devices can reduce the footprint more than ten-fold, while simultaneously improving efficiency and costs.

Photonic integration allows for networks of gas sensors, as well as gas sensors integrated into the smartphone.

Value Proposition/USP

Half of the methane emissions worldwide are due to agriculture. Emission levels cannot be legislated or controlled, as no cheap and compact sensor with sufficient detection level is commercially available. Recent research shows the feasibility of photonic integrated circuits (PICs) as highly sensitive and selective gas detectors. We develop optical detectors for methane and other relevant gases that use tested telecom components and are ready for out-of-lab applications.

Business Opportunity/Objective/Commercial Perspectives

PIC gas sensors can be used for environmental monitoring in livestock farming, or any other facility with significant greenhouse gas emission. They can also find applications in air quality monitoring and hazardous gas detection, such as required for the petrochemical industry. They can furthermore be used as reliable fire detection systems, e.g., in the aerospace or automotive industry. Lastly, handheld high-end optical devices can find medical applications.

Technology Description/Technology Summary

Photonic integrated circuits combine multiple functions on a single, millimeter-sized optical chip. As such, complete tunable laser systems and modulators can be embedded in a microscopic volume. This has been used for telecom applications in the past, but recent work identified possibilities for PIC gas sensor. PICs can provide the benefits of optical gas detection – selectivity, sensitivity, speed and longevity – at a much lower cost, with a lower footprint and a higher efficiency than bulk optical devices.

Development Phase/Current State

TRL 3 – Individual components have been tested, and high quality circuits are available for fabless user. Based on those performance parameters, the feasibility has been shown theoretically. Fully integrated devices need to be developed, that can be packaged and tested against the state of the art. First circuits have been developed at AU, but experimental verification is work in progress. The fabrication eco-system is currently scaling to TRL 7, in so-called Pilot Lines.

The inventors

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Seeking

- Interested (industrial) partners
- Research collaborations, e.g. in the field of gas sensing

Intellectual property rights (1-2 l… …ons nummer/prioritetsdato