

III-V/Si photonic integrated circuits and their applications in spectroscopy

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Photonic integration allows the realization of miniaturized, robust and low-cost optical systems. While the original focus of photonic integration was on datacom and telecom applications, the use of photonic ICs is expanding towards sensing applications, such as sensors for LiDAR. Optical spectroscopic sensing is another area where photonic integrated circuits can provide disruptive solutions, such as for implants that continuously measure glucose levels in diabetes patients, smart watches that probe the concentration of bio-molecules under the skin using diffuse reflectance spectroscopy, cheap CO₂ sensors that monitor indoor air quality, etc.

In this paper I will discuss the work that is carried out in the Photonics Research Group dealing with photonic integrated circuits for optical absorption spectroscopy. This includes the realization of integrated optical spectrometers, tunable lasers, frequency comb sources, midIR photo-thermal spectroscopy on-chip, a hollow-core waveguide platform with midIR LEDs and PDs integrated, midIR ATR sensors etc. The use of these subsystems for analyzing solids, fluids and gases will be discussed.