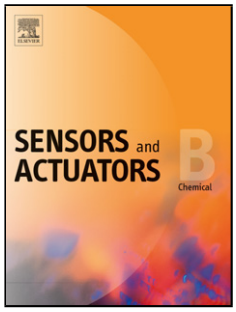

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Mid-infrared photonic gas sensing using a silicon waveguide and an integrated emitter

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Abstract

The miniaturization of optical gas sensors is of interest for automotive and consumer electronics. We recently presented the use of silicon waveguides for evanescent-field gas detection in the mid-infrared by using an external laser source. However, the feasibility of the method is not guaranteed when the laser source is replaced by an integrated light source, typically a thermal emitter, due to the lower emitted power of the latter. Here, after experimentally characterizing the evanescent-field ratio of the fabricated structures, we demonstrate the feasibility of gas detection using a silicon waveguide and a low-cost integrated thermal emitter. Specifically, using the first demonstrators we achieve CO_2 detection down to a concentration of 10% with a confidence level of three standard deviations. The current detection limit is close to that previously measured with an external laser source and it is mainly limited by the yet not-optimized waveguide structure. This research represents a promising advancement for the development of fully-integrated photonic gas sensors in the mid-infrared.

Keywords:
Optical gas sensing, Evanescent-field absorption, Silicon photonics, Beer-Lambert law

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