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Title: Carbon dioxide sensing using integrated optical sensors – a new tool for capnography

Abstract: Optical spectroscopy is among the most important chemical analysis techniques due to its high specificity and long-term stability. For spectroscopic analysis of gas compositions, the mid-infrared (mid-IR) region is particularly important, owing to the rovibrational resonances in that spectral range. Hence, there is great interest in miniaturizing and reducing the power consumption of optical spectroscopic sensors, but until recently, the mid-IR range has been out of reach. We demonstrate spectroscopic sensing of carbon dioxide (CO₂) using an integrated silicon waveguide at the strong absorption peak at 4.23 μm wavelength.

In the clinic, exhaled CO₂ can give insight into a host of parameters that are related to human health. For example, the concentration of exhaled CO₂ closely represents the CO₂ concentration in the pulmonary deoxygenated arteries, which is especially important during operations performed under anesthesia. We discuss the possible application of our new sensor technology to this important task.