New developments in Quartz enhanced photoacoustic gas sensing in the Infrared and THz spectral ranges

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Quartz-enhanced photoacoustic spectroscopy (QEPAS) is a very powerful technique that allows selective and sensitive measurements of trace gases in an ultra-small acoustic detection module (ADM) with a total sample volume of only a few mm^3 [1]. The principle of this technique is based on the photoacoustic (PA) effect, where the absorption of modulated laser radiation by gas molecules causes a periodic heating of the chemical species. The heating results in thermal expansion, and leads to a pressure change in the targeted media. The generated pressure wave is detected by a quartz tuning fork (QTF) acting as sharply resonant piezoelectric transducer.
I will report an overview of the latest developments in QEPAS trace-gas sensor technology such as the design and realization of custom QTFs with different geometries providing an enhancement of optoacoustic generation efficiency [2], QEPAS sensors operating in QTF first overtone flexural mode [3] and QEPAS sensors employing a single-tube acoustic micro-resonator providing an improvement of the detection sensitivity by two orders of magnitude compared to a bare QTF [4].

References

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