PAC

Process Analytical Chemistry - Data Acquisition and Data Processing

Main location	Vienna (Vienna)
Other locations	Vienna, Kundl (Tirol), Salzburg, Lenzing (Upper Austria), Krems (Lower Austria)
Thematic field	Gaining valid chemical information directly from the process streams of chemical and biochemical industry, inline and in real-time.

Success story summary

QEPAS: quantum cascade lasers sniffing for trace gases

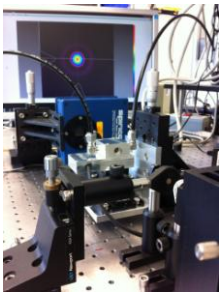
A compact sensor system based on quartz-enhanced photoacoustic spectroscopy (QEPAS) employing a mid-infrared (mid-IR) quantum cascade laser (QCL) was developed for trace gas detection at sub-ppm concentration levels. The sensor system proves excellent suitability for industrial process gas monitoring, with other potential application fields such as environmental monitoring and medical diagnostics.

Success story

Mid-IR laser based QEPAS is a very sensitive and selective technique that allows measurements of trace gases. The gas is therefore analyzed in an ultra-small acoustic detection module with a total sample volume of a few mm³. The use of QCL technology assures both selectivity and sensitivity by targeting single, strong absorption lines of the analytes under investigation. In contrast to classical photoacoustic spectroscopy this technique uses a 32,768 kHz quartz tuning fork (QTF) as a sharply resonant transducer for acoustic waves, which are induced in an absorbing gas by modulated optical radiation. The QTF is a piezo-electric element and allows measuring its deformation by the acoustic pressure waves as a voltage sensed by the instrument's electronic circuits.

An essential benefit of the QEPAS technique is the possibility to development a very compact and robust sensor with very high sensitivity and selectivity, and also the capability of fast data acquisition and analysis. Moreover, the developed QEPAS technique is generic in nature and can be quickly adapted to other analytes simply by changing the used quantum cascade laser.

Within the framework of PAC a portable QEPAS prototype for detection of CS_2 at low ppm concentration levels in industrial environment was successfully developed. Starting with first fundamental QEPAS experiments at the Vienna University of Technology, a rugged laboratory setup including data acquisition and processing was developed and thoroughly tested. Based on these developments a compact prototype was assembled, and also successfully tested in an industry environment at the project partner Lenzing AG.



QEPAS labortory setup

portable QEPAS trace gas sensor

Impact and effects

The developed QEPAS prototype allows selective and stable trace gas measurements. Its proven ruggedness opens the path for product development and future successful long-term use in industry. The high quality of the obtained data can contribute to ensure work place safety and can be of key relevance to guarantee constant and high product qualities.

Contact:	K-Project PAC – Process Analytical Chemistry RECENDT GmbH, Robert Holzer Altenberger Straße 69, A-4040 Linz +43 (732) 2468 - 4602 robert.holzer@recendt.at www.recendt.at	Prof. Bernhard Lendl Technische Universität Wien Getreidemarkt 9/164 UPA, A-1060 Wien +43 (1) 58801 – 15140 bernhard.lendl@tuwien.ac.at