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Accession number:20114814563020
Title:Real-time, subsecond, multicomponent breath analysis by Optical Parametric Oscillator based Off-Axis Integrated Cavity Output Spectroscopy
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Source title:Optics Express
Abbreviated source title:Opt. Express
Volume:19
Issue:24
Issue date:November 21, 2011
Publication year:2011
Pages:24078-24089
Language:English
E-ISSN:10944087
Document type:Journal article (JA)
Publisher:Optical Society of America, 2010 Massachusetts Avenue NW, Washington, DC 20036-1023, United States
Abstract:Breath analysis is an attractive field of research, due to its high potential for non-invasive medical diagnostics. Among others, laser-based absorption spectroscopy is an excellent method for the detection of gases in exhaled breath, because it can combine a high sensitivity with a good selectivity, and a high temporal resolution. Here, we use a fast-scanning continuous wave, singly-resonant Optical Parametric Oscillator (wavelength range between 3 and 4 um, linewidth 40 MHz, output power >1 W, scanning speed 100 THz/s) with Off-Axis Integrated Cavity Output Spectroscopy for rapid and sensitive trace gas detection. Real-time, lowppbv detection of ethane is demonstrated in exhaled human breath during free exhalations. Also, simultaneous, real-time multi-component gas detection of ethane, methane and water was performed in exhaled breath using a wide spectral coverage over 17 cm-1 in 1 second. Furthermore, realtime detection of acetone, a molecule with a wide absorption spectrum, was shown in exhaled breath, with a sub-second time resolution (0.4 s).
Number of references:34