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Applications of Quantum Cascade Lasers

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Novel pulsed and cw quantum cascade distributed feedback (QC-DFB) lasers operating in the 4.3 to 24 μm spectral range with cw power levels of ¿100 mW are now available for the detection and quantification of trace gases in ambient air by means of sensitive absorption spectroscopy. Recent advances in photonic technologies and spectroscopic detection schemes have been employed in various sensor platforms to achieve minimum detectable absorption coefficients of 10^{-9} cm^{-1} in real world applications. The QC laser based gas sensor architecture depends on the concentration levels of a desired trace gas species. A number of gases such as CH_4, N_2O, NO, CO, NH_3, C_2H_5OH, and H_2O have been detected and quantified to date in ambient air and other gas mixtures with sensitivity of several parts per billion by volume [1]. Detection of biomedically produced nitric oxide (NO) is of particular importance because of its critical role in human physiology. NO in human breath samples was detected by its fundamental absorption at 5.2 μm (1921.6 cm^{-1}) using cavity enhanced and cavity ringdown techniques. 1. Anatoliy A. Kosterev and Frank K. Tittel, IEEE JQE Special Issue on QC Lasers 38, 582-591 (2002).

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