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# Infrared semiconductor laser based trace gas sensor technologies: recent advances and applications

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This talk will focus on recent advances in the development of sensors based on infrared semiconductor lasers for the detection, quantification and monitoring of trace gas species and their application in atmospheric chemistry, medical diagnostics, industrial process control and security. The development of compact trace gas sensors, in particular based on quantum cascade and interband cascade lasers permit the targeting of strong fundamental rotational-vibrational transitions in the mid-infrared, that are one to two orders of magnitude more intense than overtone transitions in the near infrared [1-3]. The architecture and performance of several sensitive, selective and real-time gas sensors based on near and mid-infrared semiconductor lasers will be described. High detection sensitivity at ppbv and sub-ppbv concentration levels requires a sensitivity enhancement scheme such as an optical multipass gas cell, cavity absorption enhancement technique, or photo-acoustic absorption spectroscopy [2,4,5]. These three spectroscopic methods can achieve minimum detectable absorption losses in the range from $10^{-8}$ to $10^{-11}$ $cm^{-1}/\sqrt{Hz}$. Several recent examples of real world applications of field deployable gas sensors will be described.

**References:**

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