

Title: Mid-infrared semiconductor laser based trace gas analyzers: advances, applications and future outlook

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This talk will focus on recent advances in the development of trace gas sensor technologies, based on infrared semiconductor lasers for the detection, quantification and monitoring of trace gas species and their application in atmospheric chemistry, medical diagnostics, life sciences, industrial process control as well as security and defense [1-3]. The development of compact trace gas sensors, in particular based on quantum cascade and interband cascade lasers which permit the targeting of strong fundamental rotational-vibrational transitions in the mid-infrared and that are one to two orders of magnitude more intense than overtone transitions in the near infrared. Specifically, the spectroscopic detection and monitoring of six molecular species, such as ammonia (NH₃), nitric oxide (NO), carbon monoxide (CO), sulfur dioxide (SO₂), methane (CH₄), nitrous oxide (N₂O) and hydrogen peroxide (H₂O₂) will be described [4-5]. These molecules were detected using conventional photoacoustic and quartz-enhanced photoacoustic spectroscopy (PAS & QEPAS). PAS and QEPAS can achieve minimum detectable absorption losses in the range from 10⁻⁸ to 10⁻¹¹ cm⁻¹/√Hz. Several recent examples of real world applications of field deployable gas sensors and future developments will be described.

References:

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