

Diode and Quantum Laser Based Gas Sensors For Chemical and Environmental Analysis

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The development of compact gas sensors based on diode and quantum cascade lasers and some of their potential applications in the petrochemical industry to trace species detection in the infrared fingerprint region, where most molecules possess characteristic ro-vibrational absorption spectra, will be reported. Ultra-sensitive, highly selective and real-time concentration measurements of various gases, such as CO, CO₂, NH₃, NO, N₂O, CH₂O and CH₄ have been demonstrated. Some of the recent advances in photonics technologies have been employed in various sensor technologies to achieve minimum detectable absorbances of 10⁻⁵ and reliable, long-term operation. In particular, the development of robust mid-infrared spectroscopic sources that are based on difference frequency generation (DFG) and quantum cascade (QC) lasers, has led to a number of gas detection and monitoring applications suitable for chemical analysis and industrial process control in the petrochemical industry