LED-Absorption-QEPAS Sensor for Biogas Plants

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Abstract

A new sensor for methane and carbon dioxide concentration measurements in biogas plants is presented. LEDs in the mid infrared spectral region are implemented as low cost light source. The combination of quartz-enhanced photoacoustic spectroscopy with an absorption path leads to a sensor setup suitable for the harsh application environment. The sensor system contains an electronics unit and the two gas sensors; it was designed to work as standalone device and was tested in a biogas plant for several weeks. Gas concentration dependent measurements show a precision better than 1% in a range between 40% and 60% target gas concentration for both sensors. Concentration dependent measurements with different background gases show a considerable decrease in cross sensitivity against the major components of biogas in direct comparison to common absorption based sensors.

Keywords: optical sensing, spectroscopy, photoacoustic, absorption, biogas

"….The detection of methane was done with an LED emitting around $\lambda_{methane}$ = 3.4 µm with a quasi continuous wave (cw) optical power of $P_{methane}$ = 0.2 mW (IoffeLED Ltd—LED34Sr). The detection of carbon dioxide was realized with an LED emitting around λ_{carbon} = 4.2 µm with a quasi cw optical power of P_{carbon} = 0.04 mW (IoffeLED Ltd—LED42Sr)…"