

QCL online CF₄ analyzer

With quantum cascade lasers (QCL) emerging on the market, mid-IR applications for laser-type analyzers have become available. NEO Monitors in Norway have commercialized the first online monitor for CF₄. And SINTEF was one of the first customers.



Tunable diode laser monitors are moderate cost, low maintenance instrument that sees wide-spread applications in industry. With the commercial availability of QCL lasers, applications in the mid-IR spectral range became available. The NEO LaserGas Q CF₄ scans over a spectral range near 1283 cm⁻¹ to record the absorbance by tetrafluoromethane CF₄.

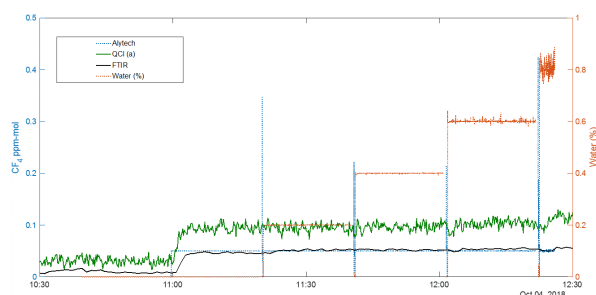
PFC Emissions

Formation of perfluorocarbons occurs in aluminium industry as a result of insufficient aluminium oxide supply in the reduction process. The concentrations are low, but these PFCs are potent greenhouse gases. Industry are therefore required to report a budget of their emission.

One way to monitor PFC emissions from aluminium production is by use of a flange mounted QCL laser. Use of CaF₂ windows can withstand the corrosive HF gases. Instrument is pre-calibrated, and will report concentrations online through a WIFI access point. Data can be reported at a frequency of 1 Hz.

Instrument validation

Since the instrument uses a very limited spectral range, spectral interference from other gases cannot easily be compensated for. SINTEF has validated the effect of two relevant interferences: water and methane.



For water, no significant interference was found between 0 and 0.8 % vol. For methane, an interference of 3.1 ppb mol per ppm mol of methane was quantified.

Instrument sensitivity was also evaluated in the laboratory using a 0.3 m gas cell. The instrument sensitivity was given as 20 ppb mol * meters. For a 0.3 m cell, this implies 67 ppb mol. The test performed in the lab indicated that the detection limit was better than reported by NEO. For industrial monitoring, the path can be much longer thus providing better detection limits. This is countered by particulates in the gas, dispersing the light. Operational detection limit for an installation on the duct of the gas treatment center with 100+ cells has not yet been estimated.

Contact:

Thor Anders Aarhaug—taarhaug@sintef.no