



COMBINATION OF OFCEAS SPECTROSCOPY AND LOW PRESSURE SAMPLING, AN ADVANTAGE FOR LOW CONCENTRATION MEASUREMENTS FOR CEMS

OFCEAS or Optical Feedback Cavity Enhanced Absorption Spectroscopy, is a gas analysis technology developed by the University Joseph Fourier. OFCEAS essentially differs from the older technology enhanced-cavity TDLAS by its feedback principle: a part of the emitted radiation is returned from the chamber to the laser, enabling the tuning of the laser and the cavity, creating a resonance phenomenon. The measuring cavity in which the sample is analysed is equipped with high reflectivity mirrors (>99,99%), providing an optical path up to 20 km, in a small 40cm cell. The consequence of this phenomenon is the identification of intense absorption peaks with narrow spectral width. The system presents very high measurement stability: there is no zero and no span drift and no need for regular calibrations.

LPS or Low Pressure Sampling, is a patented sampling technique. The pressure is maintained under 100mbar absolute from the sampling point to the exhaust of the analyser. Given that the transfer time is reduced, the dew point is decreased below ambient temperature, the interferences between absorption picks is minimised.

The combination of OFCEAS and LPS was implemented in gas analysers. At the beginning the goal was to use it for research purposes by the University Joseph Fourier, to measure very low concentration of gases in ambient air. But quickly the technology attracted the interest of the industry, and the technology is now used worldwide in CEMs and process applications.

For Continuous Emission Monitoring, OFCEAS and LPS provide many advantages.

OFCEAS allows advanced levels of detection, and measurement range can be from parts per billion to percentage. It can measure standard gas species (O₂, NO_x, SO₂, CO, CO₂, H₂O), but also gases with growing interest in emission (HCHO, H₂S, HF, HCl, CH₄, NH₃) even at low concentrations. The technology is also self-referenced, and not deviating system, so there is no need of regular calibration. A direct measurement of all gas species is made every 100msec, without calculation treatment.

LPS (Low Pressure Sampling) below 100mbar absolute, reduces the dew point in the sampling which is a critical point for wet gases like in CEMS conditions. For CEMS, lines don't need to have a regular heating at 180°C, LPS will allow usage of lines traced at 40°C to 80°C, and will avoid problems of cold spots in winter. The low pressure also has an impact on the absorption spectrums. The lower the pressure is, the thinner are the absorption picks, which allows differentiation of gas species in a same spectrum. The cross-interferences becomes very limited, and trace measurement becomes possible even with high concentration of CO, CO₂, hydrocarbons, and H₂O. Finally, the low pressure uses limited amount of sampled gas, around 20L/h for CEMs. A low flow of emission gas sampled also means a low amount of particles

sampled. The accumulation of dust in the filters of the analyser is reduced by ten, and the cost of spare parts is reduced.

The applications for continuous emissions monitoring are numerous, but the main advantages foreseen are:

- Waste incineration: Waste incineration requires the monitoring of certain compounds. In particular: HF, HCl, NH₃, and NO_x. And the emission limits for those compounds are expected to be lowered, according to the direction given by the BREF. OFCEAS is able to measure these gases in ppb concentrations, way below current thresholds. Which might not be the case for older technologies (NDIR, FTIR). OFCEAS might in this case be the only current technology able to reach those low certified ranges in the near future.
- Gas turbines & wood panels: OFCEAS is also able to measure formaldehyde in flue gas, as low as 1ppb limit of detection. Formaldehyde measurement is required by the EPA on combustion turbines, to demonstrate that formaldehyde emissions do not exceed 91ppb, dry basis, corrected to 15% O₂. The most common solution to measure formaldehyde that low has been to use a modified FTIR with extended cavity. OFCEAS could be a more affordable alternative, due to its 20km path length. The wood panel industry is also interested to control formaldehyde emissions, and could also be interested to implement it.

OFCEAS could be also of interest for gas turbines when it comes to low CO measurements, as its limit of detection for CO could be as low as 1ppb.

- Refinery and petrochemical plants: analysers combining OFCEAS and LPS are easily implementable in ATEX enclosures. The use of 80°C sampling lines, instead of 180°C standard lines, also reduces the problem of temperature classes in explosive areas. OFCEAS is also able to measure O₂ with a mid-IR laser, when FTIR cannot and would require a secondary zirconia sensor, which is not easily implementable in explosive areas due to its high temperature. Therefore, an ATEX integration of the



OFCEAS is very attractive for industrial installations with explosive area requirements, like petro chemical plants.

Furthermore, the measurement of low concentrations of H_2S in the flue gas by OFCEAS from 50ppb to 100ppm, is also useful when refineries are required to control their sulfur emissions.

In conclusion, the combination of OFCEAS and LPS allows a new approach of continuous emissions monitoring. And it could be a perfect answer to the lowering of the emission limits by the authorities in the near future (BREF). Gas compounds such as HF, HCl, NH_3 , CO, H_2S , and formaldehyde, could be easily measured in ppb concentrations. The applications where those level of performances are required are numerous, and could relieve many industrials from measurement constrains encountered by older installed instrumentation technologies.

Instruments based on OFCEAS and LPS technologies, LaserCEM[®], are already certified by TUV and MCERTS regarding EN 15267. And the manufacturer AP2E, part of DURAG group, is able to supply LaserCEM[®], as well as complete CEMS instrumentation (including DAHS, dust, flow, Hg) via DURAG partners and durag subsidiaries, worldwide.



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