



New light from laser technology

Introducing the Vaisala SPECTRACAP® Oxygen Transmitter OMT355

Vaisala Instruments has recently made a significant entry into a new market segment by launching its first product for industrial oxygen measurements - the Vaisala SPECTRACAP® Oxygen Transmitter OMT355.

The new product introduces a novel concept for oxygen measurement by featuring an insertion probe with a built-in optical spectrometer. Using advanced laser technology, the instrument combines state-of-the-art measurement performance with robustness that enables in-situ measurements in conditions where this has been unimaginable until now.

Oxygen for all

Oxygen is one of the most common elements found in nature. In the Earth's crust, it is most predominantly present in the form of silicate and oxide minerals, in the oceans as a major constituent of water. In its gaseous form of a diatomic oxygen molecule O₂, oxygen makes up 20.9% of the Earth's atmosphere.

Industrial uses of oxygen are numerous and diverse. The chemical industry uses it to improve the yield of many chemical and petrochemical manufacturing processes. Many industries use it for wastewater treatment, water purification or enhancement of other types of aqueous reactions. In fermentation processes it is used to improve fermentation yield, and in a number of combustion processes it is used to boost the process for a better and cleaner burn.

In-line measurement for best results

Any process parameters are best measured in-situ, with a sensor that is

located inside the process at a representative location. For many process control parameters this is not possible, but measurements are made from gas or liquid samples drawn from the process continuously, or even from samples taken manually and measured in a laboratory afterwards with a significant delay.

Continuous sampling is often employed for process gas oxygen measurements. Depending on the composition and conditions of the process gas, varying schemes are used to render the gas sample suitable for the sensitive gas analyzer. This may include gas drying, cooling, particulate removal, flow rate stabilization and filtering for removing liquid water or harmful chemicals from the sample. Apart from adding cost and complexity to the measurement system, the sample treatment may even affect the composition of the gas sample, causing an error or a bias in the measurement result.

In the OMT355 product concept, the oxygen measurement probe can be installed directly - even in a demanding wet or aggressive process environment - with a flange mount.

Durable probe for difficult conditions

The Vaisala SPECTRACAP® Oxygen Transmitter OMT355 is designed to endure difficult chemical environments. The main construction material of the probe is AISI316 stainless steel. Other wetted materials are SiN and MgF₂

optical coatings and, depending on selected sealing and filter options, PTFE, EPDM or Kalrez®. The optical surfaces are protected from dust and dirt with a stainless steel mesh filter and an optional hydrophobic porous PTFE filter. Should any particles or dirt surpass the filter barriers, the measurement algorithm of the SPECTRACAP® sensor is designed to tolerate a significant level of light obscuration. It even issues a warning signal of the situation for the user well before the measurement performance is affected.

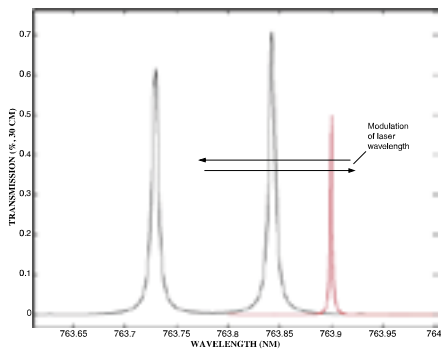
Sampling cell option

In cases where the OMT355 probe cannot be inserted directly in the process, for example due to too high process pressure or temperature, a stainless steel sampling cell can be used. Thanks to the robustness of the probe and the small pressure and flow dependencies of the SPECTRACAP® sensor, in most cases a very simple sampling system can be used.

Smooth connectivity and configuration

All the Vaisala SPECTRACAP® Oxygen Transmitter OMT355 versions feature a clear LCD display and a four-key keypad to access the instrument





In the TDL method the wavelength of the diode laser light source is continuously swept over a gas absorption peak.

control functions locally with menu structured commands. For security reasons the keypad is located under the instrument cover with some of the commands password protected to prevent tampering with the transmitter. Using the RS232 or RS485 serial communications of the device, a full set of control commands is available by using a laptop or a terminal device. Other configurable features of the OMT355 are an analog mA output with user-defined error states, and an alarm/fault relay with user-defined setpoints.

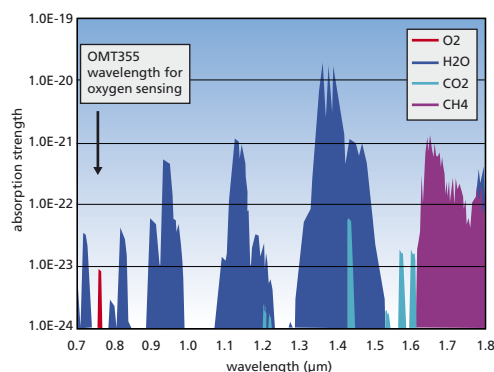
Many applications

The OMT355 measures oxygen concentration in % levels, upwards from approximately 0.2 % O₂, and can be used in practically any application where oxygen levels need to be monitored in the % range. The advantages of the SPECTRACAP® sensor and the OMT355 product concept are, however, most striking in demanding applications where the user can benefit from the 12-month calibration interval and the robustness of the in-line probe.

In fermentation processes, the oxygen and carbon dioxide levels in the fermentor off-gas give crucial information on the state of the microbial process. The OMT355 is ideally suited for real-time oxygen measurement in the high humidity gas emerging from an industrial fermentor, even at high gas flow rates and velocities often encountered in large-scale facilities. Even more demanding conditions can be found, for example, in large composting facilities, where the oxygen concentration in the exhaust gas is an important measure of how aerobic the process is.

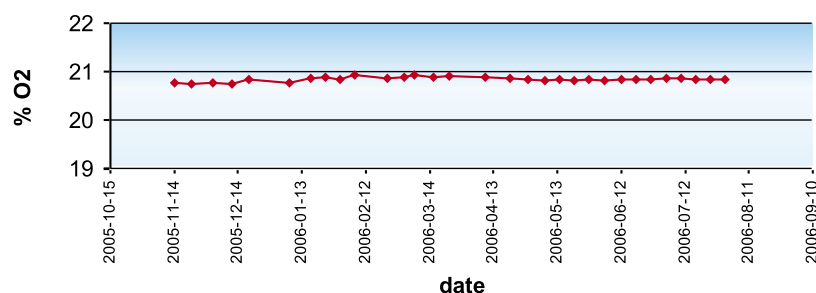
The Vaisala SPECTRACAP® sensor

The Tunable Diode Laser (TDL) technology used in the SPECTRACAP® sensor is one of the most powerful gas measurement technologies on the market today. The technology is based on measuring the attenuation of a beam of laser light in the sample gas. For oxygen sensing, the laser - a small semiconductor chip - is tuned to a wavelength which is characteristic and unique for the oxygen molecule. Since no other gas absorbs light precisely at the same wavelength as oxygen, the measured attenuation is an extremely selective measure for the amount of oxygen on the path of the laser beam.



◀ *Absorption wavelengths of some commonly known gases. The oxygen absorption does not overlap with other gases.*

▼ *Illustration of the long-term stability of the Vaisala SPECTRACAP® Oxygen Transmitter OMT355. The graph shows the weekly average readings of a transmitter installed outdoors for 9 months, with open exposure to ambient weather.*



In the SPECTRACAP® sensor, this advanced technology is for the first time implemented in a compact and robust probe suitable for industrial measurements. The optical design of the sensor is a result of an elaborate optimization based on both theoretical modeling and thorough experimental work.

The SPECTRACAP® sensor contains no moving parts or sensitive components exposed to the measured gas, which for the user means a measurement performance that is unaffected by vibrations, orientation or even aggressive chemicals.

The fundamental optical absorption principle combined with the highly optimized sensing algorithm used in the sensor yield a very stable measurement. The semiconductor lasers used in the sensor have undergone extensive aging tests that show a lifetime in excess of ten years of continuous operation.

Inert blanketing gases are used in a number of applications for minimizing or removing explosion hazards or for protecting perishable goods from the effects of oxidation or microbial activity. The OMT355 is an excellent solution for monitoring inert gas quality both in the gas supply such as an inert gas generator, and in the blanketed area such as a product storage tank or container.