

CO₂ Sensors

CO₂



Non-invasive & in-process monitoring

- Re-usable & disposable sensors
- Dissolved carbon dioxide monitoring

CO₂ Sensors



The CO₂ sensors measure the partial pressure of dissolved carbon dioxide. The spots are fixed on the inner surface of a glassware or transparent plastic material. The CO₂ concentration can therefore be measured in a non-invasive and non-destructive manner from outside, through the wall of the vessel.

Features

- Online monitoring
- Non-invasive & non-destructive measurement
- Measurement range from 10 – 250 hPa pCO₂ (8 ... 180 mmHg)
- No consumption of carbon dioxide
- Measures carbon dioxide in liquids
- Beta-irradiated and autoclavable sensors available

Sensor Spots

Sensor spots (SP) are the most versatile version of CO₂ sensors. They are attached to the inner surface of any transparent vessel.

Examples are

- Respirometric chambers
- Aquaria
- Flasks

The optical fiber of the transmitter can be fixed opposite the SP by using our accessories (see accessories brochure) which can be adapted for nearly all kinds of vessels.

Flow-Through Cell

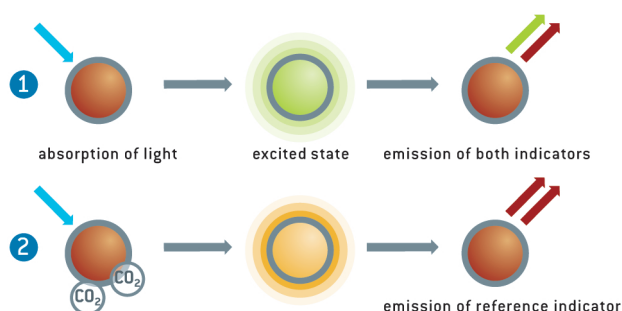
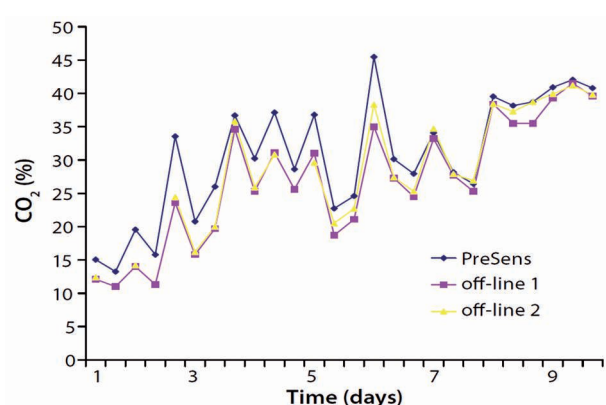
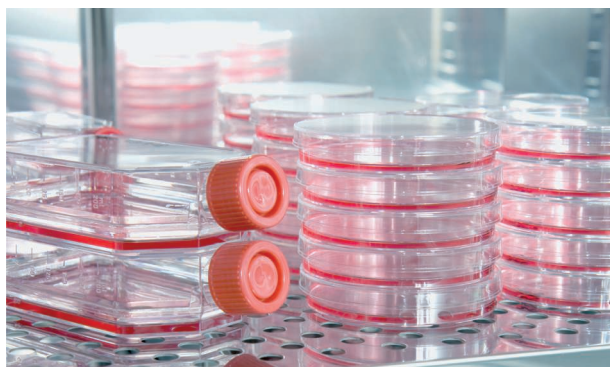
The flow-through cell carbon dioxide mini-sensor (FTC-CD1) is a miniaturized chemical optical sensor integrated in a flow-through cell. The cell is built from a 3 cm glass tube with 7 mm outer diameter with a CO₂ sensor integrated and a customized holder (FTC-Holder) fixing the polymer optical fiber for signal transduction. The cell is autoclavable.

Dipping Probe

The CO₂ dipping probe is a chemical optical sensor based on 2 mm polymer optical fiber (POF). The sensor membrane is fixed at the tubing end of the optical fiber connected to the transmitter. It is the solution for invasive measurements and monitoring.

Sensor Probes

CO₂ Sensors



Potential Applications

Biotechnology: Carbon Dioxide Monitoring in Process Development

In bioprocess development & production, monitoring dissolved CO₂ in addition to pH and O₂ provides valuable information. It ensures stress-free cultivation conditions during mammalian cell culture (e.g. CHO cell-line). Constant pH and / or oxygen supply and sufficient nutrition levels are key parameters to optimize yield. Thereby, excess CO₂ can act as a stressor or even a toxin to the culture and has to be controlled. The chemical optical CO₂ sensors can enhance performance of process monitoring during cultivation in disposables, leading to process optimization.

PreSens CO₂ Sensors as an Alternative to Off-Line Sampling

PreSens CO₂ sensors were evaluated for monitoring the cultivation cells in a 3-L bioreactor. The sensors show excellent long-term stability over a period of 10 days during cell cultivation of CHO cells with an initial seed density of 400,000 cells/mL. The readings of the PreSens CO₂ sensor offer the possibility to continuously monitor the CO₂ concentration between two off-line measurements.

Rick Baggio, Millipore Corporation, Bedford, MA, USA, Poster Presentation at ESACT2009, Dublin

Scientific: Carbon Dioxide Monitoring for Biological Applications

Increased CO₂ uptake from the atmosphere caused by anthropogenic sources is believed to cause ocean acidification, with not yet foreseeable effects on marine life and ecosystem. Monitoring pCO₂ in experimental set-ups simulating future levels of carbon dioxide can help to gain knowledge on the effects of ocean acidification on marine fauna. Besides the marine application, monitoring pCO₂ also allows knowledge to be gained on land-based plant physiology. Monitoring pCO₂ helps increasing yield during aquaculture of fish (fish farming) by providing convenient growth conditions. Excess carbon dioxide levels need to be monitored as this leads to hyperventilation of sea animals.

Dual Lifetime Referencing - An Internal Referencing Method

The chemical optical CO₂ sensor is based on our patented DLR measurement principle. The light of the blue LED excites the sensor to emit fluorescence. The luminescence lifetime measured is a superposition of the signals of an analyte sensitive indicator and an inert reference indicator, where both indicators exhibit very different luminescence lifetimes and the luminescence of the analytic sensitive indicator can be suppressed by CO₂. The measurement signal correlates to the partial pressure of carbon dioxide.

Sensor Probes

CO₂ Sensors

pCO ₂ Sensors	
Specifications*	
Measuring range	1 – 25 % CO ₂ at atmospheric pressure (1013.15 hPa) 10 – 250 hPa pCO ₂ 8 – 180 mmHg pCO ₂
Response time (t ₉₀) at 20 °C	< 3 min. for change from 2 % to 5 % (15 mmHg - 38 mmHg) pCO ₂
Resolution at 20 °C	± 0.06 % at 2 % CO ₂ ± 0.15 % at 6 % CO ₂ ± 0.5 mmHg at 15 mmHg pCO ₂ ± 1.2 mmHg at 45 mmHg pCO ₂
Drift at 37 °C **	> 0.01 % CO ₂ per 7 days
Precision	± 5 % of reading or 0.2 % (1.5 mmHg); whichever is higher
Operating temperature	From + 15 °C to + 45 °C
Properties*	
Compatibility	Aqueous solutions, pH 4 – 9
Cross-sensitivity	Optical pCO ₂ sensors display reduced cross-sensitivity to ionic strength (salinity); acetic acid, SO ₂ , HCl vapours
Stability	pCO ₂ sensors do not stand: organic solvents, pH above 10 or below 4
Storage	6 months provided the pCO ₂ sensor is stored in its original package
Cleaning	Depends on the sensor type used - please ask our experts
Calibration	pCO ₂ spots are pre-calibrated; re-calibration is possible Beta-irradiated or autoclavable pCO ₂ sensors available

* provided pCO₂ spots are used without further handling in physiological solutions

** in a carbon dioxide incubator with 100 % rel.Hum. at 5 % CO₂; measurement interval of 1 min.

Transmitters & Accessories



pCO₂ mini
Fiber optic carbon dioxide transmitter



FTC Holder
The FTC holder is used to connect the FTC-CD1 to the pCO₂ mini.



SOA Adapter
The stick-on adapter SOA is used for transparent vessels with planar surface.



Coaster CFG
The coaster CFG is used for shake flasks.



ARC Adapter
The adapter for round containers ARC is used for spinner flasks or similar vessels.

Technical data can change without prior notice.

Bring to light what's inside. Ask our experts:

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