



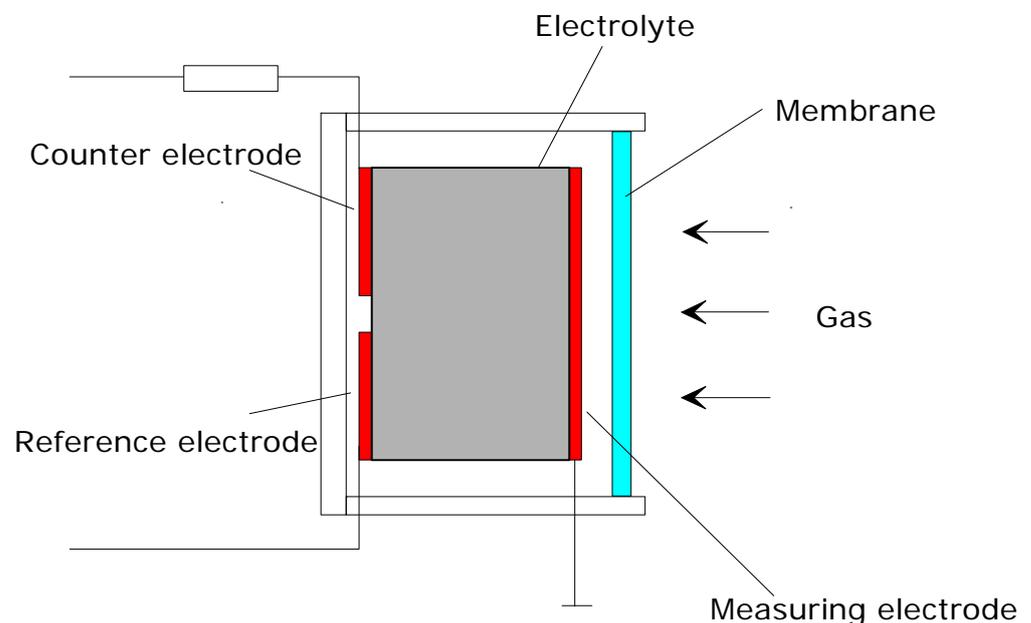
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Electrochemical detection principle (EC)

An electrochemical sensor consists of a chamber with two or three electrodes and an electrolyte. A membrane, such as a porous PTFE-sheet, prevents the electrolyte from leaving the chamber. Gas, however, can pass through the membrane and reach the electrodes. The electrodes are usually made of platinum or gold. An electrochemical reaction with the gas takes place on the measuring electrode. Electrons are released and diffuse to the counter electrode. The current produced by the electrodes that diffuse from one electrode to the other is proportional to the gas concentration.

Electrochemical sensor

The reference electrode produces a constant voltage between the measuring electrode and the counter electrode. Most gases react only within a small range of the reference voltage. Electrochemical sensors are available for many gases (H_2S , HCN , CO , Cl_2 , SO_2 , H_2 , NO , and NO_2).



Electrochemical sensor for oxygen

Electrochemical sensors are often used to measure oxygen. These sensors are set up similarly to galvanic cells. They have 2 electrodes, made of different materials, and an electrolyte. Usually gold and lead electrodes are found in the oxygen sensor. The oxygen diffuses through a PTFE-membrane to reach the electrodes.



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Electrochemical reaction

- Measuring electrode: $4 \text{ OH}^- + 2 \text{ Pb} \rightarrow 2 \text{ PbO} + 2 \text{ H}_2\text{O} + 4 \text{ e}^-$
- Counter electrode: $\text{O}_2 + 2 \text{ H}_2\text{O} + 4 \text{ e}^- \rightarrow 4 \text{ OH}^-$

There are oxygen sensors that measure partial pressure and those that directly measure the % volume. GfG oxygen sensors directly measure the % volume. % volume sensors measure the percentage of the gas in the atmosphere, which in clean, dry air is 20.9% volume of oxygen. Partial pressure is defined as the pressure the gas will have if no other gas is in the mixture. The concentration of the gas is independent from the absolute pressure. The partial pressure changes in proportion to the absolute pressure. For clean, dry air at an absolute pressure of 2 atm, the following applies:

% Volume of O ₂	Partial Pressure of O ₂
20.93 Vol%	0.419 atm

The output signal of a sensor measuring partial pressure changes with the absolute pressure. The sensor must be calibrated if it is used in higher or lower altitudes (i.e. mountains or mines). On the other hand, the signal of a % volume measuring sensor is unaffected by altitude changes. The oxygen % volume does not change.

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