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TECHNOLOGY DESCRIPTION

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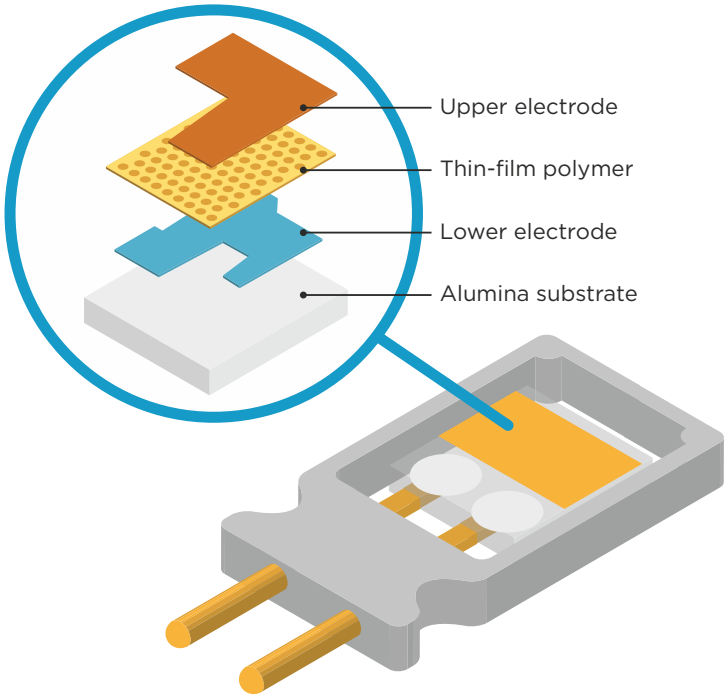
Vaisala PEROXCAP® Sensor for Measuring Vaporized Hydrogen Peroxide, Relative Saturation and Relative Humidity



PEROXCAP's unique benefits

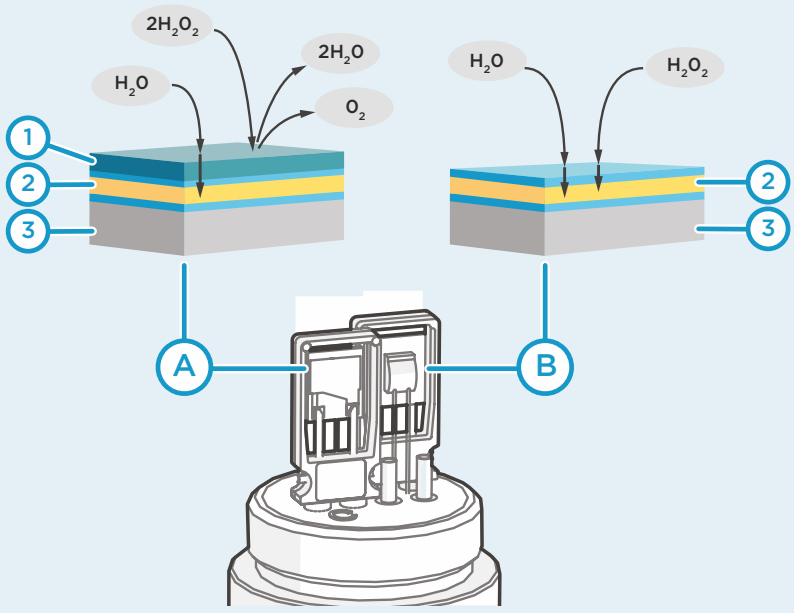
- Repeatable measurement
- Excellent long-term stability
- In addition to H_2O_2 ppm measurement, the sensor also measures humidity and temperature when combined with an additional temperature sensor
- Unique Relative Saturation parameter indicates the combined humidity of both H_2O_2 vapor and water vapor
- Tolerates high humidity and measures accurately even in 100% relative saturation
- Accurate measurement with a traceable H_2O_2 factory calibration
- Long product lifetime and annual calibration interval
- Optional on-site calibration

Unique capacitive thin-film polymer sensor for repeatable measurement

PEROXCAP sensor technology works using measurements from two HUMICAP® sensors. Vaisala HUMICAP sensors guarantee quality and reliability, with their reputation for repeatability, accuracy, excellent long-term stability, and negligible hysteresis, even in the most demanding high-concentration H_2O_2 applications in atmospheric pressure. HUMICAP is a thin-film polymer sensor consisting of an Alumina substrate on with a thin polymer film between two electrodes. The polymer film absorbs or releases vapor according to humidity changes in the environment. As the humidity changes, the dielectric properties of the polymer film change, and so does the capacitance of the sensor. The instrument's electronics measure the capacitance of the sensor and convert it into a humidity reading.

The upper electrode is made of corrosion resistant conductive material and functions as one of the two electrodes in the capacitor. It protects the active material of the sensor from dust, dirt and conductive particles.

The thin film polymer is sandwiched between the two electrodes. This conductive layer absorbs water and H_2O_2 vapor. The advanced upper electrode is one of the secrets behind a cutting-edge humidity sensor. The amount of vapor absorbed is proportional to the ambient relative humidity (sensor with catalytic layer) or relative saturation.



Operating principle of PEROXCAP measurement

A HUMICAP sensor with a catalytic layer (under the probe filter). This sensor only senses water vapor.

B HUMICAP sensor without a catalytic layer (under the probe filter). This sensor senses the air mixture with both hydrogen peroxide vapor and water vapor.

1 Catalytic protection layer over the thin-film polymer. This layer catalyzes hydrogen peroxide into water and oxygen and prevents it from entering the sensing polymer.

2 Thin-film polymer between two electrodes.

3 Alumina substrate.

The thin film polymer layer amplifies the amount of water and H_2O_2 in the air. We synthesize our own polymers in order to optimize sensor performance.

The lower electrode is made of corrosion resistant conductive material and functions as one of the two electrodes in the capacitor.

Intelligent PEROXCAP measurement technology

PEROXCAP measurement uses two HUMICAP sensors: one HUMICAP sensor with a catalytic layer and the other one without the catalytic layer. The catalytic layer catalyzes hydrogen peroxide from the vapor mixture. Therefore, the HUMICAP sensor with the catalytic layer only senses water vapor, providing a measurement of partial water pressure, i.e. relative humidity (RH). The other HUMICAP sensor without the catalytic layer senses the air mixture with both hydrogen peroxide vapor and water vapor. The difference between the readings from these two sensors indicates the vapor concentration of H_2O_2.

Repeatable measurement even in high humidity

The PEROXCAP sensor is warmed using a chemical purge function. This purging process involves rapid heating of the sensor to remove possible impurities and condensation. This allows the sensor to provide reliable measurement, even in environments where the humidity is near saturation because the heating prevents condensation on the sensor.

PEROXCAP's intelligent measurement technology, including the chemical purge function, helps maintain measurement accuracy between calibration intervals in challenging environments. The unique PEROXCAP technology was developed to provide stable and repeatable measurements.

Multi-parameter measurement

Combining the PEROXCAP sensor with an additional temperature sensor allows up to three measurement parameters: hydrogen peroxide vapor concentration, temperature, and humidity, referring to both relative humidity and relative saturation.

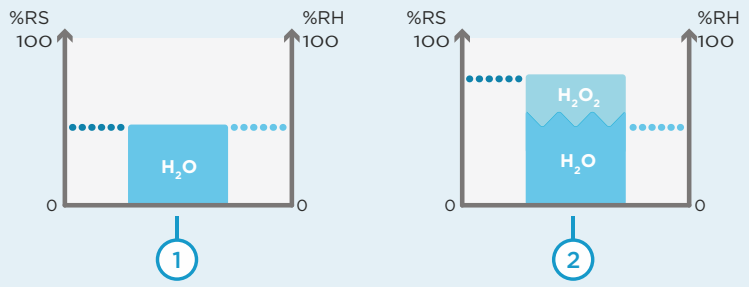
Water and hydrogen peroxide have a very similar molecular structure; both affect the humidity of the air in which they are present

- **Relative saturation** indicates the humidity of the air caused by both H_2O_2 vapor and water vapor. When relative saturation reaches 100 %RS, the vapor mixture starts to condense.
- **Relative humidity** is a parameter that indicates the humidity of the air caused only by water vapor.

Traceable H_2O_2 factory calibration

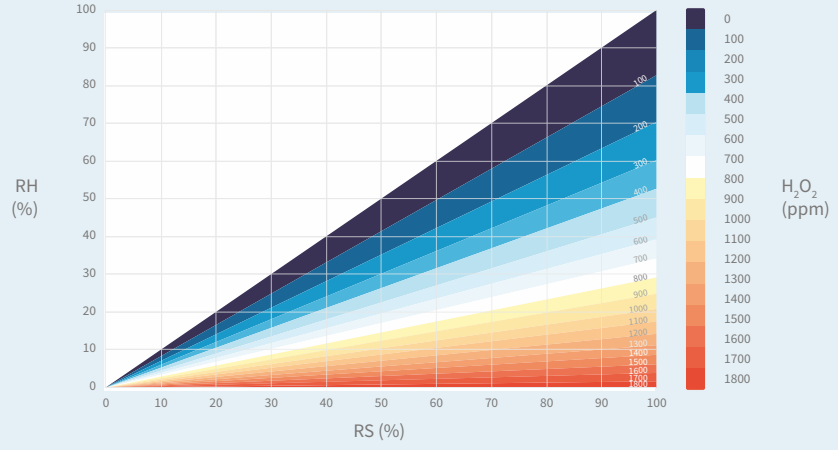
Every PEROXCAP sensor is manufactured in Vaisala's own cleanroom and individually calibrated at the Vaisala factory. Both H_2O_2 and RH calibrations are traceable to international SI units, which ensures that the measured values represent the real environment.

The effect of H_2O and H_2O_2 on relative saturation (RS) and relative humidity (RH)



1 Space without H_2O_2 vapor. When H_2O_2 vapor is not present, relative saturation equals relative humidity.

2 Same space with H_2O_2 vapor introduced. Relative saturation is higher than relative humidity.



For example, at 20 °C and 500 ppm hydrogen peroxide, the humidity level 25%RH is equivalent to 60%RS. When this gas mixture starts to condense (relative saturation being 100%), relative humidity is 45%.

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