

Pewatron Application Note PAN-03: Zirconia oxygen gas sensor – cross sensitivity to other gases and materials

The FCX zirconia oxygen sensor works excellent and reliable in a number of applications, including CO₂ incubators, nitrogen and oxygen concentrators, oxygen transmitters and in fruit & vegetable storage applications. Zirconium oxide (with proper dopant elements; zirconia) when heated > 350 °C is penetrable for oxygen ions. The FCX oxygen series has the working point at 450°C. A voltage applied to the oxygen-sensing element, pumps the oxygen out of a closed inner chamber. At a constant gas pressure, the quantity of oxygen pumped out is equal to the quantity of oxygen molecules diffusing in through a small capillary hole. It is independent of the voltage applied between the electrodes within a certain range. The measurement current is proportional to the quantity of oxygen molecules pumped away. Because of the high temperature and the voltage driving force for oxygen diffusion, there is number of gases and materials, which can result in a false oxygen concentration measurement or can destroy the oxygen sensing element. In this application note, we will discuss most of these gases and material that have an adverse effect on the oxygen-sensing principle of the zirconia sensor.

Combustible Gases

Small amounts of combustible gases does not burn at the hot sensor surfaces, but they can decompose because of a high applied voltage across the sensor element. Below the decomposition voltage, the sensor will measure the residual oxygen pressure.

Gases investigated:

- H₂ (Hydrogen) up to 3%
- CO (Carbon Monoxide) up to 3%
- CH₄ (Methane) up to 4%
- CO₂ (Carbon dioxide) up to 80%

Heavy Metals Vapors

Pt (Platinum), Zn (Zinc), Cd (Cadmium), Pb (Lead), Bi (Bismuth) will have a negative effect on the catalytic properties of the oxygen sensing electrodes. Exposures to such metal vapors must be avoided.

Halogen and Sulphur Compounds

Small amounts (< 100ppm) of Halogens and/or Sulphur compounds have a negative effect on the lifetime and performance of the oxygen sensor. These types of gases cause sensor degradation.

Gases investigated:

- Halogens, F₂ (Fluorine), Cl₂ (Chlorine)
- HCL (Hydrogen Chloride), HF (Hydrogen Fluoride)
- SO₂ (Sulphur Dioxide), H₂S (Hydrogen Sulphide)
- Freons, CFCs (Chlorofluorocarbon)

Nitrous gases

Exposure to nitrous gases in ppm levels change the catalytic effect of the Pt-electrodes and result in false signals. This can be the case for NO_x and NH_x gases.

Gases investigated:

- NO₂ (Nitrogen Dioxide)
- NO_x (Nitrogen oxides)
- NH₃ (Ammonia)

Others

Gases evaporating from silicone compounds or rubbers are to be avoided. Ppm levels of SiO₂ and Si reacts with the Platinum electrodes or blocks the pores and active parts of the electrodes.

VOC or other organic gases in high concentrations and with a low decomposition temperature can have a negative influence on the lifetime and performance of the oxygen sensor

For humidity and water condensation issues concerning the sensor performance, please refer to Pewatron application note PAN-04

Headquarter Switzerland:
Pewatron AG
Thurgauerstrasse 66
CH-8050 Zurich
Phone +41 44 877 35 00
info@pewatron.com

Office Germany:
Pewatron Deutschland GmbH
Edisonstraße 16
D-85716 Unterschleißheim
Phone +49 89 374 288 87 00
info.de@pewatron.com



PEWATRON
SENSORS · POWER SOLUTIONS

We are here for you. Addresses and Contacts.

Sales Germany & Austria

**Geometrical sensors
Other products**

Kurt Stritzelberger
Phone +49 89 374 288 87 22
kurt.stritzelberger@pewatron.com

**Pressure sensors
Other products**

Gerhard Vetter
Phone +49 89 374 288 87 26
gerhard.vetter@pewatron.com

Gas sensors and modules

Peter Felder
Phone +41 44 877 35 05
peter.felder@pewatron.com

Sales Switzerland & Liechtenstein

Postcode 3000 – 9999

Basil Frei
Phone +41 44 877 35 18
basil.frei@pewatron.com

Postcode 1000 – 2999

Christian Mohrenstecher
Phone +41 76 444 57 93
christian.mohrenstecher@pewatron.com

Sales International Key Accounts

Peter Felder
Phone +41 44 877 35 05
peter.felder@pewatron.com

Sales Other Countries / Product Management

**Pressure Sensors
Load Cells**

Philipp Kistler
Phone +41 44 877 35 03
philipp.kistler@pewatron.com

**Gas sensors
Gas sensor modules**

Dr. Thomas Clausen
Phone +41 44 877 35 13
thomas.clausen@pewatron.com

Flow / Level / Medical products

Dr. Adriano Pittarelli
Phone +49 89 374 288 87 67
adriano.pittarelli@pewatron.com

Power supplies

Sebastiano Leggio
Phone +41 44 877 35 06
sebastiano.leggio@pewatron.com

**Linear position sensors
Angle sensors**

Eric Letsch
Phone +41 44 877 35 14
eric.letsch@pewatron.com

Drive technology
CH Postcode 5000 – 9999 / DE

Roman Homa
Phone +41 76 444 00 86
roman.homa@pewatron.com

**Accelerometers
Sensor elements**

Christoph Kleye
Phone +49 89 374 288 87 61
christoph.kleye@pewatron.com

**Current sensors / Power solutions &
Turkey**

Osman Coban
Phone +49 89 374 288 87 65
osman.coban@pewatron.com

Drive technology
CH Postcode 1000 – 4999 / AT / IT / FR

Christian Mohrenstecher
Phone +41 76 444 57 93
christian.mohrenstecher@pewatron.com

Harald Thomas
Phone +49 89 374 288 87 23
harald.thomas@pewatron.com