GEN'AIR

OXYGEN ELECTROCHEMICAL PUMP

Based on the ionic conduction properties of zirconia, **GEN'AIR** makes it possible to create and measure very different oxygen atmospheres.

The **GEN'AIR** is composed of three parts:

- The Pump: it depletes or enriches with oxygen the gas passing through its zirconia tube. It requires a low gas flow: between 1 and 12 l/h. It can be used for inert gas/oxygen mixtures or buffered/oxygen mixtures such as CO / CO_2 ou H_2 / H_2O.

- The Sensor: it measures the oxygen partial pressure generated by the pump.

- The automation system: It allows for controlling the current applied to the pump. The associated software offers two operating modes: **Continuous**, where the partial pressure is manually adjusted, and **Recipe**, which allows loading recipes to adjust the partial pressure of oxygen and the duration of desired steps. The number of segments for this product is 12 and the maximum number of iterations is 10.

The use of MicroPoas®[1] gives it an excellent response time and very good measurement accuracy.

1 - Brevet ANVAR/CNRS/UNIV. Grenoble.

• ITS STRENGTHS

- Generation and analysis of atmospheres with controlled oxygen levels
- Use of carrier gases in small quantities
- Cost limitation by using a single gas
- High working dynamics
- Compact and safe system
- Limited maintenance and servicing
- Excellent measurement stability
- Measurement of oxygen partial pressure from 10^{-30} to 0.25 atm

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PRINCIPAL OF OPERATION

THE PUMP:

A touch-screen allows for data visualization, and another one is used for pump settings. It enables the regulation of the pump either by current or directly by pO_2.

The flow of oxygen generated by the pump in the case of oxidizing or neutral gas can be calculated using the formula:

$$X = X^0 \pm 0.209 \frac{I}{D}$$

With:
X°: molar fraction of oxygen before the pump
X: molar fraction of oxygen after the pump
I: current [A]
D: carrier gas flow rate [l/h]

THE GAUGE:

Placed after the pump, it is used to validate the partial pressure generated by the pump. The measure is performed using the MicroPoas®, a zirconia probe with a metallic internal reference.

Like all zirconia probes, the MicroPoas operates according to **Nernst's law**:

$$E = \frac{RT}{4F} \ln \frac{Pmes}{Pref}$$

In the case of the MicroPoas®, the reference is set by an equilibrium a metal and its oxide.

EXEMPLE OF PERFORMANCES

At 5l/h and 800°C, the performances obtained with different carrier gases are as follows:

Gas	pO_2 mini	pO_2	pO_2 maxi
Air	17.2%	20.9%	25%
Nitrogen	10^{-8} atm	10^{-7} atm	10^{-2} atm
Ar+5%H_2	10^{-30}atm	10^{-27}atm	10^{-24}atm
CO/CO_2*	10^{-19}atm	10^{-17}atm	10^{-16}atm

* Note that the CO/CO_2 balance is not very stable in these conditions.

TECHNICAL DATA

MESURING PRINCIPALE	MicroPoas®, zirconia probe with internal metal reference
MEASUREMENT RANGE	10^{-30} to 0.25 atm*O_2
FLOW RATE	From 1 to 12 l/h**
OUTPUT SIGNALS	RS232 protocol proprietary
DIMENSIONS AND WEIGHT	482x133x360 mm (wxhxp) – 10kg
POWER SUPPLY	115 – 230 Vac – 50/60 Hz
POWER	450 VA

*Measuring traces of oxygen with a zirconia probe is tricky because the presence of traces of impurities such as combustible compounds can create instability. This is particularly true in the 10^{-8} to 10^{12} atm O_2 range. The use of buffered mixtures makes it possible to generate reducing atmospheres in a controlled manner.
** Flow control must be provided by an external system. The use of a mass flow regulatoris recommended (consultus).