JBCE Responds to the public consultation for Exemption 1(b) of RoHS Annex IV

1, December 2020

JBCE would like to provide our contribution to the public consultation.

As we are an applicant of the renewal exemption above, as for our argument, we would like you to refer our application. However, we would like you to consider that the same measurement principle is applied both for Oxygen gas sensor and for Dissolved Oxygen sensor. Please find the attached in detail.

If you have any further questions, please do not hesitate to contact to us.

We are looking forward to continued contribution during the consultation phase of evaluation.

Yours sincerely,

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ABOUT JBCE

Founded in 1999, the Japan Business Council in Europe (JBCE) is a leading European organisation representing the interests of over 85 multinational companies of Japanese parentage active in Europe.

Our members operate across a wide range of sectors, including information and communication technology, electronics, chemicals, automotive, machinery, wholesale trade, precision instruments, pharmaceutical, railway, textiles and glass products.

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Lead anodes in electrochemical oxygen sensors

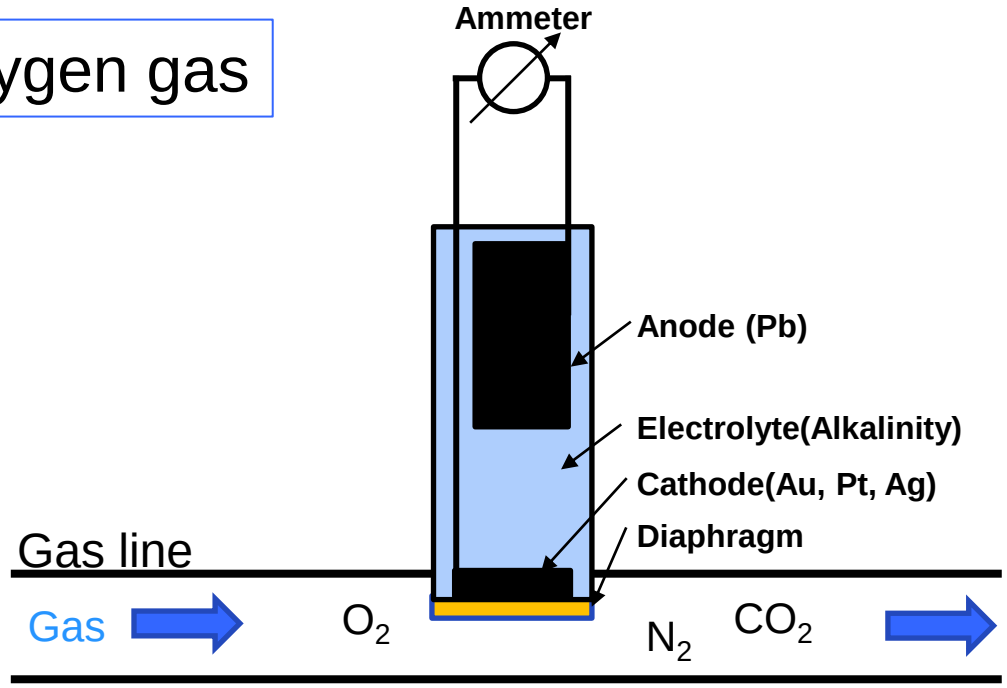
for Oxygen gas and for Dissolved Oxygen

1. December 2020

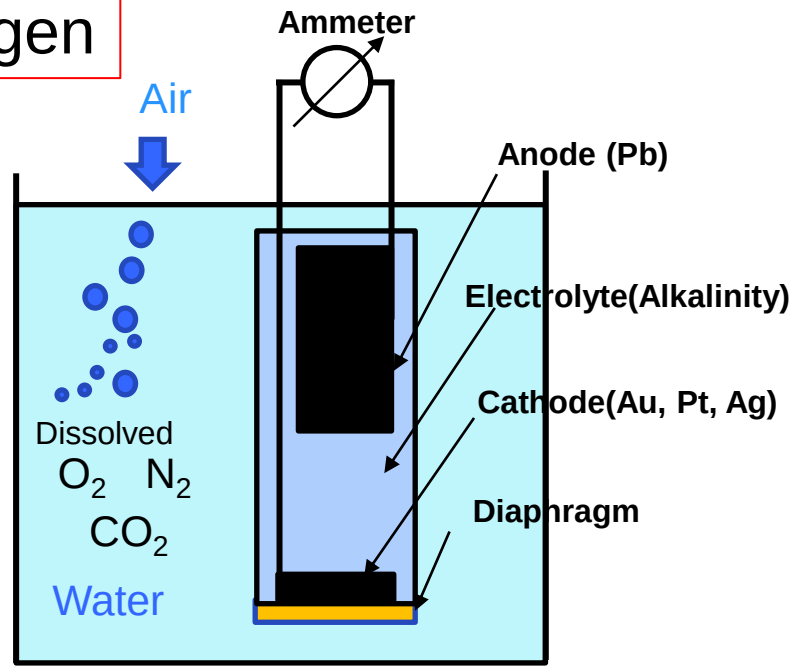
Difference between Oxygen gas and Dissolved Oxygen sensor (in galvanic electrode method)

Electrochemical oxygen sensors that uses lead as the anode (galvanic electrode method) is available both for detecting Oxygen gas and dissolved oxygen.
The amount of the oxygen through the sensor diaphragm is proportional to the Partial Pressure of Oxygen.

Oxygen gas



Dissolved Oxygen

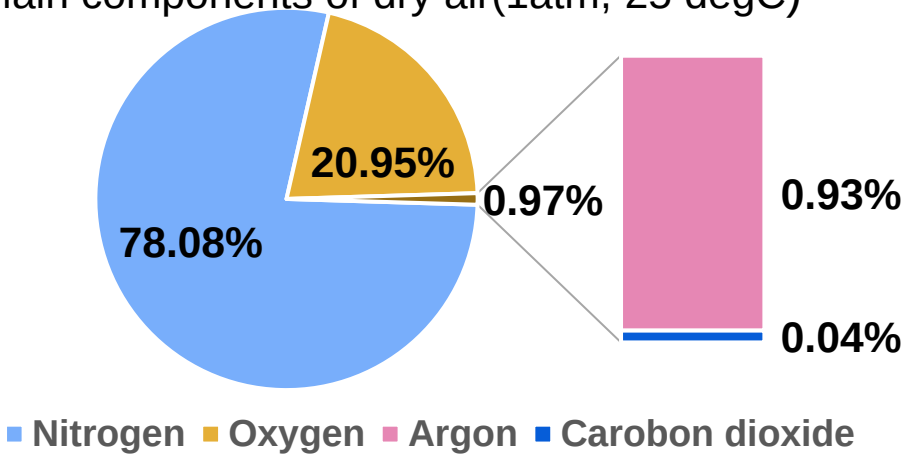


Even the same measurement principal is applied, the dissolved Oxygen sensor needs a waterproof structure, instead of the oxygen gas sensor does not need it.

Partial pressure(Oxygen gas vs Dissolved Oxygen)

Oxygen gas

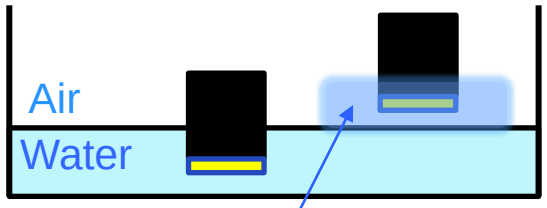
Main components of dry air(1atm, 25 degC)



The atmospheric pressure at sea level, P(air)=101.3 kPa, Amount of Oxygen is 20.95%, so Partial Pressure of Oxygen,pO_2(air) is

101.3kPa x 20.95% = 21.22 kPa

Dissolved Oxygen



Saturated humidity air(near water surface)

Partial pressure of dissolved oxygen, pO_2(**water**) near water surface is the one subtracted the saturation vaper pressure of water, p(water) from p(air), and Saturation vapor pressure of water is 3.17kPa(25degC).
So Partial Pressure of DO, pO_2(**water**) is

20.95% x (p(air)-p(water)) =20.95%x(101.3- 3.17) = 20.56 kPa

How to convert the concentration(Oxygen gas vs Dissolved Oxygen)

Oxygen gas

Unit of Percent (%) is used for the concentration of oxygen gas.

Current value at 20.95% of Oxygen gas concentration(As)
Current value at 0% of Oxygen gas concentration(Az)
Current value when measuring “sample gas” concentration(A_0)

Concentration of “sample gas”(%) = $20.95\% \times (A_0 - Az) / (As - Az)$

Dissolved Oxygen

Unit of weight percent (mg/L) is used for the concentration of dissolved oxygen.

It is the same condition between Saturated humidity air(near water surface) and under water. In the case dissolved oxygen measurement, we can calibrate the sensor in the air.
The saturated dissolved oxygen (1atm, 25degC) is 8.26mg/L[1].

Current value at 8.26mg/L of Dissolved Oxygen concentration(Asw)
Current value at 0mg/L of Dissolved Oxygen concentration(Azw)
Current value when measuring “sample solution” concentration(A_{0w})

Concentration of “sample gas”(%) = $8.26\text{mg/L} \times (A_{0w} - Az) / (As - Az)$

[1]ISO5814, Water quality-Determination of dissolved oxygen- Electrochemical prove Method,A3. Solubility of oxygen in water in ANNEX A

Summary/Key message

- Measurement principle of oxygen sensor is same between oxygen gas and dissolved oxygen.
- Some parameters such as partial pressure, and saturated concentration, due to the different condition in the air or in the water.
- However, concentration conversion way is same.
- Dissolved oxygen sensor is required higher detectivity compare to the oxygen gas sensor, because the dissolved oxygen has lower saturated value compare to the oxygen gas.