Oxygen removal principle on the ULOCE-500 ultralow oxygen partial pressure control equipment

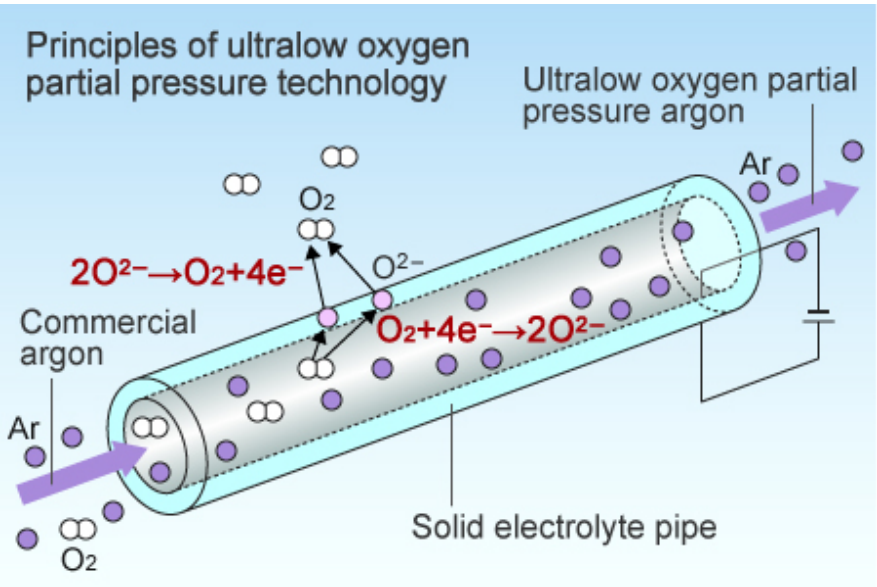
About ultralow oxygen partial pressure technology

Our ultralow oxygen partial pressure control equipment removes oxygen that is contained in inert gas (such as nitrogen, argon or helium) to ultralow levels. The oxygen partial pressure of the obtained gas (nearly the same oxygen concentration, depending on the gas) is lower than 10^{-30} atm. An oxygen partial pressure of 10^{-30} atm is equivalent to having only a single oxygen molecule exist in an amount of argon gas contained in a single-story building that is 100m wide and deep (approximately 37,200m^3). As the amount of oxygen is extremely small, oxidation suppression or reduction functions can be achieved in gases that are originally inert.

Conventionally, hydrogen gas is commonly used for oxidation suppression or reduction. However, hydrogen gas causes hydrogen embrittlement or absorption to opposing materials. Consequently, hydrogen cannot be used in many circumstances. As the danger of fires and explosions also exists, hydrogen gas cannot be used in dangerous locations or high-temperature environments.

Ultralow oxygen partial pressure gas eliminates concerns about fire and explosion, so such gases can be used in environments where fire or explosion is a danger for oxidation suppression or reduction. Furthermore, heat-treating materials with an adequate oxygen partial pressure enables the adjustment of a material's oxidized state to impart higher properties and new characters.

Principle of removing oxygen



It is well known that ions can move in liquid, like the electrolytes in rechargeable batteries. Some solid materials have same property. Materials with this characteristic are collectively known as solid electrolytes.

Our ultralow oxygen partial pressure equipment uses an oxygen ion conductive solid electrolyte, zirconium oxide (zirconia), to remove oxygen. The principle is described below. The solid electrolyte is shaped into a tube, electrodes are formed on the inner and outer surfaces, and a voltage is applied.

When Conventional inert gas is supplied on one end of the tube, impurities including oxygen are obtained as oxygen ions from electrons on the inner-surface electrode. Oxygen ions pass through the tube wall to the outer-surface electrode, and then release electrons and return to oxygen.

After being returned to oxygen, oxygen molecules cannot pass through the wall of the tube, so they are dispersed into the atmosphere without returning inside the tube.

In this manner, oxygen passes one way, from the inside of the tube to the outside. However, the inert gas cannot permeate the pipe walls of the solid electrolyte, so it so passes through the tube.

As a result, at the exit of the tube we obtain inert gas from which oxygen has been eliminated.

Contact Us

Please contact cmi-sales-ml@mail.canon with any inquiries about equipment or technologies. We can also evaluate samples.