

Use of zirconium oxide oxygen probes for heat treatment

Zirconium oxide oxygen probes play a key role in the heat treatment industry, particularly for measuring the carbon potential (%C) in carbonitriding and carburizing atmospheres. These advanced tools help optimize procedures, guaranteeing consistent, precise quality of treated parts.

1. Operating principle

Oxygen probes work by measuring the oxygen content of the high-temperature furnace atmosphere. They use a clean, dry reference air sample injected into an internal reference chamber. This air flow guarantees a stable and constant basis for comparing the concentration of oxygen present in the furnace atmosphere.

Zirconium oxide, the probe's main material, becomes an ion conductor at high temperatures (from 600°C). When the difference in oxygen concentration between the reference air and the furnace atmosphere is significant, an electrical potential is created. This signal is then interpreted to calculate the carbon potential using precise thermodynamic equations. The use of clean reference air is crucial to ensure reliable and accurate measurements.

2. Description of Econox CarboProbe ZI Pro, ZS and ST-E heat treatment probes

Carboprobe probes are high-precision oxygen probes specially designed for demanding industrial applications. Featuring advanced zirconium oxide technology, they offer optimum performance over a wide range of operating conditions.

Main features :

- **Zirconium oxide sensor:** Precise, reliable measurement of oxygen concentration and temperature in heat treatment chambers.
- **Integrated thermocouple:** Available with S, K or N options, for simultaneous measurement of temperature and oxygen.
- **Rugged construction:** designed to withstand harsh industrial environments and temperature variations.
- **Installation flexibility:** Compatible with a variety of industrial systems, making integration easy.

Advantages :

- **Versatility:** Ideal for a wide range of applications such as heat treatment, incineration, or gas analysis in manufacturing processes.

- **Swiss reliability:** Made in Switzerland, Carboprobe guarantees impeccable quality and consistent performance.
- **Simplified maintenance:** Their robustness reduces the need for servicing, ensuring a long service life.

Brief comparison of Carboprobe ZI PRO, ST-E and ZS PRO probes

Probe	Main feature	Key applications
Carboprobe ZI PRO	Probe resistant to thermal shock and chemical attack by salt residues.	Pot furnaces and salt quenching.
Carboprobe ST-E	Probe 100% compatible and interchangeable with Eurotherm probe	All types of furnaces and treatments
Carboprobe ZS PRO	High-end probe with LEMO electrical connector	All types of furnaces and heat treatments



Each of these probes is designed to meet specific needs, while offering Econox's characteristic reliability and Swiss manufacturing quality. For more details or a customized recommendation, please contact us at [.info@econox.ch](mailto:info@econox.ch)

3. Advantages of using Econox probes

- **Accuracy and reliability:** Econox probes provide regular, precise measurements of carbon potential, ensuring consistent quality.
- **Temperature measurement:** Thanks to an internal thermocouple of type S, K or N , these probes can also accurately measure oven temperature, offering an essential dual functionality.
- **Cost reduction:** They optimize processing cycles by avoiding excess fuel or carbon, thus reducing energy and material costs.
- **Simplified maintenance:** Their robustness minimizes the need for frequent servicing and reduces unscheduled downtime.
- **Hot-swap installation:** CarboProbe ZI probes can be hot-swapped without any special precautions, reducing downtime.
- **Compliance with standards:** They comply with strict industrial standards, guaranteeing consistent quality of finished products.

4. Concrete example of use

In a heat treatment plant, an automotive manufacturer uses Econox probes to case-harden steel gears. Here's how it works:

Initial phase:

The furnace is heated to 930°C. The probe measures the oxygen level and adjusts the flow of carbon-enriched gas to maintain a carbon potential of 0.8%.

During carburizing :

Probes continuously monitor carbon potential and issue automatic corrections via the furnace control system.

Result:

Gears feature a hard, uniform coating, increasing wear resistance and service life.



Heat treatment plant for processing automotive gears

5. Conclusion

Econox zirconium oxide oxygen probes provide the accuracy and reliability that are essential to the heat treatment industry. Their ability to measure and control carbon potential and temperature guarantees high-quality results, while reducing costs and increasing operating efficiency. They deliver consistent performance even in the most demanding environments.

When you choose an Econox probe, you're investing in a durable product that maximizes productivity and guarantees optimum performance, while embodying a commitment to excellence and innovation. Whether for pottery or industrial applications, these probes are the ideal solution for reliable, high-quality results.

Made in Switzerland, these probes reflect exceptional know-how and expertise accumulated over more than 40 years. Each product is designed to meet the most demanding industrial standards, combining precision and durability.

All our products are tested under real conditions (in a heat treatment furnace at 920°C and 0.85%C) and each one is supplied with a test certificate that can be used for your CQI-9 or AMS 2750 certifications.

Please contact us for more information info@econox.ch