



# A Comparative Study of Oxygen Probe Accuracy between a Solid Zirconia Sensor and a Commercial Sensor

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## Abstract

The performance and accuracy of the oxygen probe is crucial for heat treating operations. In this study, these properties were measured in two different probes, the Solid Zirconia sensor and a commercial sensor. Both probes were installed in the same conditions with different controllers on a carburizing furnace in a heat treat shop. Measurements were taken for a period of two months; each value was compared against the shim stock performed daily to the furnace to verify the actual carbon potential. At the end of the comparison trial, the obtained values from the probes, the corresponding shims stocks and any changes or modifications to their correction factors were statistically analyzed to provide the information required for this study. Results showed the Solid Zirconia sensor had higher accuracy and better performance against the commercial probe.

## 1.- Introduction

The oxygen probe is an in situ type device, meaning that it directly samples the atmosphere being measured. The electrical signal generated by an oxygen probe is directly proportional to the carbon potential of the atmosphere.

It is based on a theory on a hot ceramic electromechanical cell. The probe will respond to oxygen, hydrogen, carbon monoxide, water and carbon dioxide and thus can determine the oxidation potential of a gas.

The oxygen probe is a closed-end tube usually constructed of zirconia or yttria-stabilized material for temperatures up to 1600°C (2900°F). [1] A typical oxygen probe usually consists of the following in fig. 1.

When such a probe is subjected to elevated temperatures, the non porous sheath material acts as a solid electrolyte that permits the passage of oxygen ions when the inner and outer surfaces are subjected to atmospheres of different oxygen partial pressures. [2]

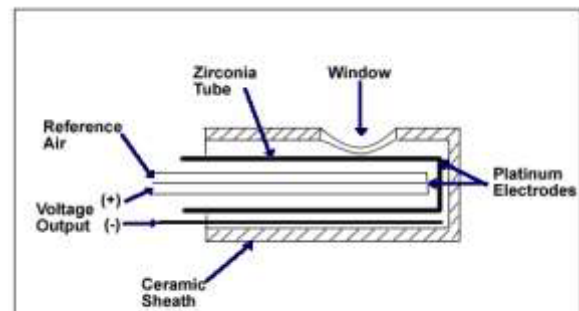


Fig 1. Components of a typical oxygen probe for controlling carburizing atmospheres.

The Solid Zirconia sensor is an oxygen probe whose innovative design permits a more accurate reading than the