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Review

# Solid electrolyte based sensors for the measurement of CO and hydrocarbon gases

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**Abstract**

Solid electrolyte based sensors are well-suited for use at high-temperatures and are thus promising candidates for measuring gas compositions in combustion environments. Oxygen partial pressures can be directly measured by a galvanic cell with an oxygen ion conducting electrolyte, but sensors for carbon monoxide and other reducing gases require more complicated mechanisms. These mechanisms rely on changes in the voltage, current or impedance associated with the oxidation of the reducing gas on the electrolyte surface, all of which depend on the kinetics of the electrode reactions. The electrode kinetics, and thus the magnitude and selectivity of the sensor response, depend on the electrolyte and electrode materials. In this paper, the materials used in solid electrolyte based sensors for the measurement of carbon monoxide and hydrocarbon gases are reviewed. Emphasis is placed on potentiometric mixed-potential sensors, but amperometric and impedancemetric sensors are also discussed.


*Keywords:* Solid electrolytes; Zirconia; Mixed potential sensors; Carbon monoxide; Hydrocarbons

**Contents**



## 1. Introduction

Optimization of a combustion process requires control of the gas composition, so systems for maintaining optimal operating conditions require measurement of the gas concentrations in the high-temperature combustion environment [1]. Chemical sensors for such measurements can be used to provide feedback for automotive engine control [2,3], as well as for combustion in other applications, such as combustion in glass making [4,5], gas appliances [6] and wood burning [7]. High-temperature chemical sensors can also be used for maintaining controlled gas atmospheres [8] and for fundamental studies of combustion processes [9]. In response to these needs, chemical sensors for measuring gases, such as $O_2$, $NO_x$ and CO, in combustion environments

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