



Chemiresistive (metal oxide) sensors for detection of chlorine

Synkera has developed a line of high-performance, rugged and reliable sensors based on nanostructured materials and micromachining. Synkera currently offers commercial sensors for detection of gases as such as H₂, VOCs, flammable gases (e.g. methane, propane), NO_x, H₂S and NH₃. These sensors are all based upon advanced and highly tailored nanostructured materials, whose resistance changes as a function of the concentration of gas molecules at the sensor surface. At elevated temperatures, physisorption and chemisorption of gases on the surface of the metal-oxide sensors lead to changes in the electronic properties of the semiconductor material. This interaction is manifested in a predictable relationship between the level of gas concentration and a change in bulk resistivity of the sensor. In numerous applications, these existing sensors have been shown to be extremely long lasting, rugged and reliable.

Chlorine Sensing

Synkera has recently performed some preliminary work on detecting Cl₂. Both thick and thin films have been evaluated, with extremely promising results. The responses were p-type in nature (resistance increases in the presence of chlorine gas) and quite strong, with response ratios >100 even at concentrations as low as 2 ppm Cl₂ (screen printed thick films). In this case, response ratio is defined as the resistance in challenge gas divided by the resistance in air. A brief study of operating temperatures showed that lower temperatures prompted the strongest sensitivity, albeit with slower response and recovery times, as compared to higher operating temperatures. Figure 1 shows the linearity of thick-film prototype sensors at higher Cl₂ concentrations and lower operating temperature. Figure 2 shows response curves for screen printed thick films at lower Cl₂ concentrations, and an operating temperature of 150°C.

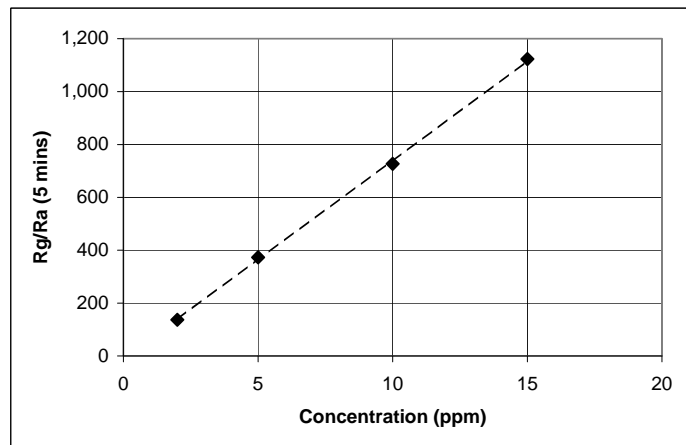


Figure 1: Response ratio of thick film sensors to 2-15 ppm Cl₂, operating temperature ~100°C.

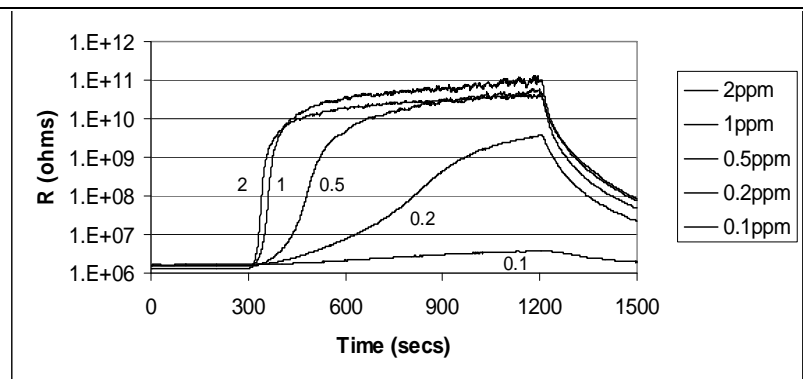


Figure 2: Response of thick film sensors to lower Cl₂ concentrations, operating temperature ~150°C.

Thinner WO₃ films prepared by



spin coating sol gel solutions have shown good response and linearity, especially at lower concentration ranges of 0.1- 1 ppm (data not shown here). Saturation of response at higher concentrations is a concern. The effect of film thickness on response should be examined.

Estimated Sensor Parameters:

Heater power required for standard microheater design: 40- 60 mW

Heater voltage input: 0.4 to 0.8V

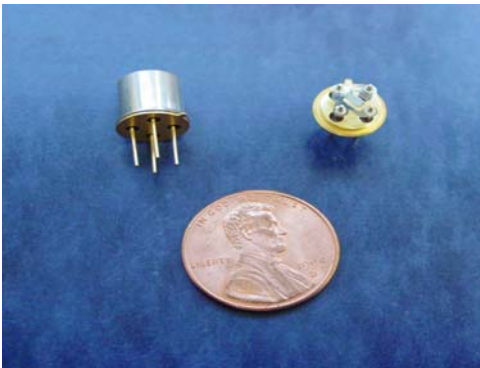


Figure 3: Prototype (standard) microsensor packaged on TO-39 header, with and without protective cap.