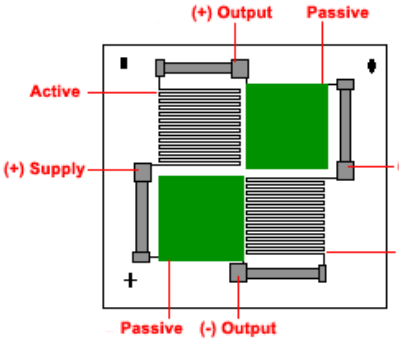
Low-cost, Thick-film Hydrogen Sensors

Patented device for fuel cell, hydrogen storage and process monitoring

Palladium Sensors Ready for Commercial Development.

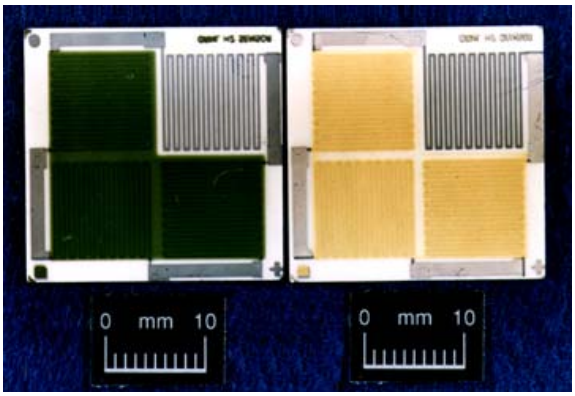
In response to the need for highly reliable, low-cost hydrogen sensors, the Oak Ridge National Laboratory (ORNL) is developing an integrated hydrogen measurement system for application to fuel cell monitoring, hydrogen storage container monitoring, and industrial process monitoring. Several years of development at ORNL that has resulted in patented devices and materials, and a wealth of background knowledge. Ongoing research will be aimed at understanding and improving the speed and reproducibility of our palladium thick-film resistive sensor, along with complementary efforts in manufacturability and further design improvements. Dynamic response of these sensors is being studied under various conditions to assess the effects of interference gases and surface poisoning and packaging schemes are being explored to optimize sensor performance and robustness.

The hydrogen economy is based on three large markets: automotive fuel cells, stationary or residential fuel cells, and portable fuel cells. All of these systems will require two types of hydrogen sensors; the first will monitor the quality of the hydrogen feed gas, and the second more important sensor system, for leak detection. ORNL is developing hydrogen detection systems that can meet the requirements of all of these markets, covering 6 orders of magnitude in detection. The cost target for these sensors is less than $50 and they can operate from –60°F to 150°F and potentially beyond. Some testing has been completed up to 400°F.



A wheatstone bridge hydrogen sensor on ceramic substrate

Features

- The ORNL hydrogen sensor is inherently manufacturable. Sensors made on standard production equipment using multiple-sensor layout (15 per substrate) are uniform and reproducible.
- Packaging concepts are under development that enables the ORNL hydrogen sensor to operate in either passive or active mode and also protects the sensor from being poisoned by harmful species that may be present in the operating environment.

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