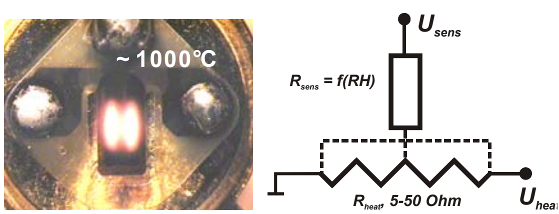
Indoor Air Quality Sensor Array

TECHNOLOGY PROFILE

OVERVIEW

Based on a patent-pending gas microsensor technology, Synkera has developed a novel microsensor platform for the detection of indoor air quality pollutants. Microsensors offer significant benefits in terms of rapid response, advanced temperature programming operating modes (e.g. pulse heating), potential for sensor array integration, and low-cost mass-manufacturing. Unfortunately, some types of microsensor platforms face significant performance and reliability challenges, especially in applications where extended operation at high temperatures or in harsh environments is required. Synkera's technology, supported by NIH SBIR Phase I funding, addresses these limitations and provides a novel microsensor architecture for the integration of nanostructured sensing elements into a robust ceramic platform. It includes (1) precision engineering of high surface area nanoporous ceramic sensing elements to achieve high sensitivity; (2) micromachining to create a low power monolithic sensor array platform, and (3) combining nanoscale control of the morphology and composition of sensing materials with advanced array operating modes to enable high selectivity. Other fundamental benefits of the platform include small size and low power consumption; superior chemical, thermal and mechanical stability; capability for high operating temperature and high temperature surface regeneration; rapid response, and flexible design and packaging options.



Single packaged sensor in operation in air and its equivalent circuit.

This new microsensor platform offers an unprecedented opportunity for the development of advanced metal oxide based sensors with improved performance characteristics. The temperature performance of the packaged microheaters is shown in Figure 1. Based on this data, it is anticipated that a family of metal oxide sensors can be developed that will operate at a power consumption of 200mW and below. Synkera's efforts have demonstrated the feasibility of this approach and have evaluated the performance of several metal oxide materials for indoor air quality measurements. The key findings to date are summarized in the next section.

RESULTS TO DATE

Durability

The sensor elements are mechanically robust and can operate at temperatures up to 800°C. Using high temperature pulses, they can be regenerated from wetting and direct contact with many organic chemicals.

Response

Good sensor response has been demonstrated with formaldehyde, carbon monoxide, toluene and ethanol. Based on the signal-to-noise analysis, the detection limit for formaldehyde detection is estimated at 0.1 ppm or below.

Repeatability

The sensor elements responded in a similar and repeatable manner during multiple exposures.

Response/Recovery Time

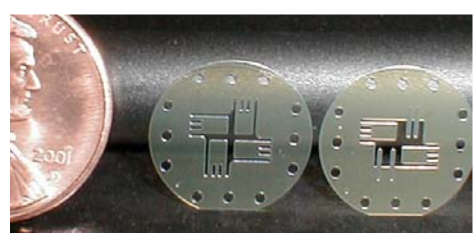
The sensor elements responded and recovered very quickly on gas exposures. The time constant of the microheater is from 0.2 to 2 (time to reach 90% of setpoint). Sensor response to gases depends on the sensor materials-gas combination, and was as fast as 5-10 seconds in some cases.

Linearity

Log-Log Response vs. concentration is very linear.

Platform Versatility

Different types of discrete solid state sensors or sensor arrays (including metal oxide, combustible gas, humidity)could be implemented using this platform, potentially enabling selective detection of air quality pollutants.



Blank sensor array substrates

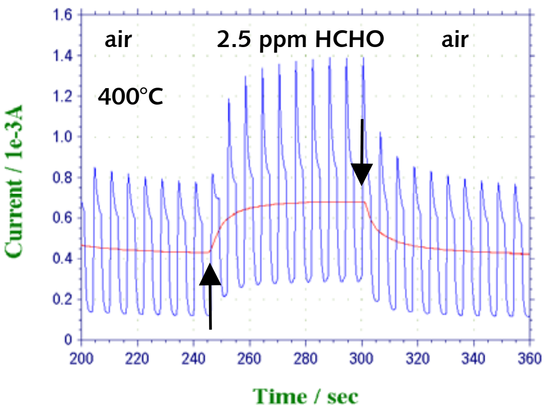
SYNKERA TECHNOLOGIES, INC.

2021 Miller Dr., Ste B, Longmont, CO 80501 www.synkera.com info@synkera.com tel 720-494-8401 fax 720-494-8402

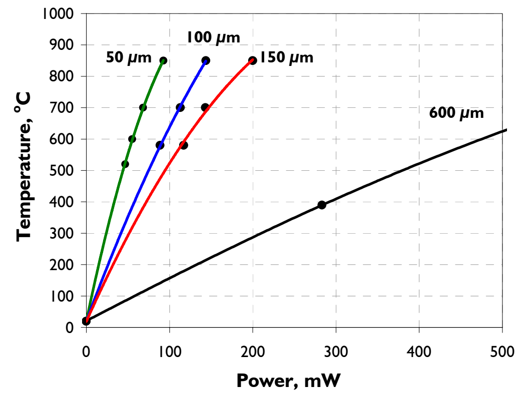
Aug. 2006

Indoor Air Quality Sensor Array

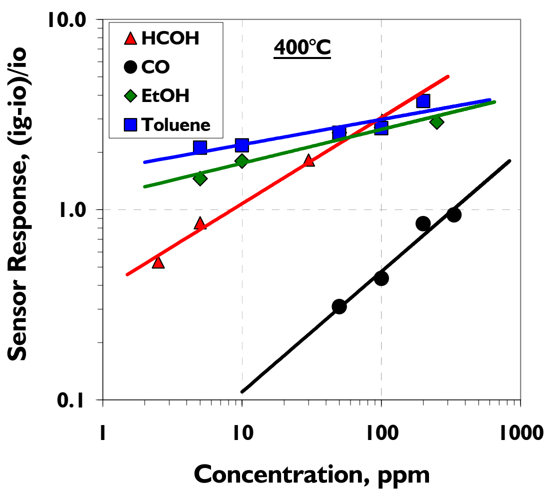
TECHNOLOGY PROFILE



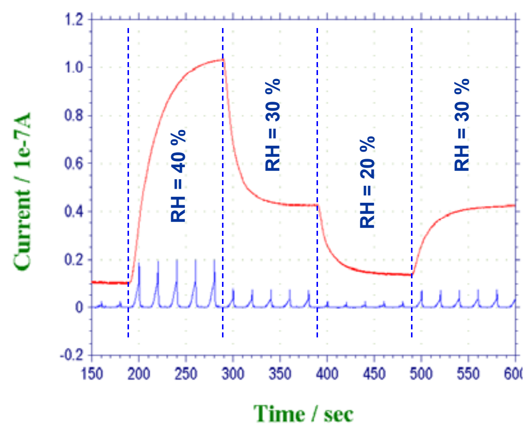
Sensor response to 2.5 ppm HCHO at constant temperature (red) and in t°-pulse (blue) mode.



Temperature vs. power characteristics for three different microheater sizes.



Sensitivity of SnO_2 microsensor to HCHO, CO, Toluene and EtOH at 400°C.



Response of humidity microsensor based on featured platform to RH changes in constant temperature (red) and t°-pulse (blue) modes.

MAJOR TASKS FOR CONTINUED DEVELOPMENT

The proof-of-concept for this technology was established during the Phase I and a proposal for Phase II funding is being submitted. The major tasks for further development of the featured technology are:

- Optimization of discrete sensors
- Development of the air quality sensor array.
- Optimization of sensor materials and deposition process.
- Extensive evaluation of sensor performance
- Field evaluation with commercial partners.

Joint development partnerships are being sought to further develop the featured air quality sensor technology for specific applications, including detection of formaldehyde and VOC's. Areas of potential collaboration include specific application development, field-testing, instrument integration, and market introduction. If you have a special application you would like to discuss, or questions you would like answered please contact:

Debra Deininger 720-494-8401X105, deininger@synkera.com.

info@synkera.com