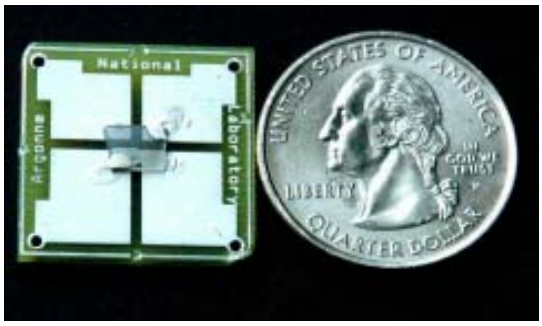
Argonne NATIONAL LABORATORY

Sensor Technology

# Hydrogen Sensor

## Ultrafast, Ultrasensitive and Inexpensive to Produce




*HYDROGEN SENSOR—The world's fastest commercially producible hydrogen sensor will be used in cars to detect unsafe levels of hydrogen.*

How do we make hydrogen use safe for cars, buses, and other mobile vehicles — as well as for many other applications that range from space exploration to mining and medicine?

Argonne's hydrogen sensor is a demonstrated technological answer to that question. Using only processes that are compatible to mass production and routinely used in the semiconductor industry, Argonne researchers have created the world's fastest, yet highly selective, low-power, commercially producible hydrogen sensor that cost-effectively, safely, and reliably overcomes the limitations associated with current hydrogen sensors.

**Features**:

- *A response time of <75 milliseconds, with 2% hydrogen.* As a result, Argonne's sensor can be used to shut off hydrogen flowing from the main tank of a hydrogen-powered vehicle before hydrogen reaches its lower limit of flammability.
- *The ability to detect hydrogen at 25 ppm without elaborate signal amplification.* As a result, Argonne's sensor can be used to detect minor or intermittent leaks that can be found and repaired before a dangerous condition requires a full system shutdown.
- *A highly selective, robust, and reproducible response to hydrogen gas without confusing readings resulting from exposure to oxygen and humidity.* As a result, Argonne's sensor can be used to detect hydrogen leaks in real-world systems under ambient conditions.

The science behind the making of the sensing elements is robust enough that they can be made on a bench top in a laboratory without elaborate cleanroom techniques. Producing these sensors under carefully controlled manufacturing conditions will make them even better.

Argonne researchers have identified a suitable self-assembled siloxane monolayer that modifies the structure of palladium at the nanoscale and have found industrial partners — like Makel Engineering, http://www.makelengineering.com/, with extra funding from EMTEC, http://www.emtec.org/, — that are committed to the commercialization of this technology.

**Benefits**

- *Faster* — Argonne's sensor's <75-ms response is faster than that of competing sensors, which have full-scale response times of one to tens of seconds, depending on the concentration.
- *More sensitive* — Few currently available sensors are capable of measuring hydrogen concentrations below 1% with an easily measurable signal.

• *More energy-efficient* — Argonne's sensor is a passive device that does not require an externalheater and requires only simple monitoring of resistance.
• *Inexpensive* — Argonne's technology allow for large numbers of these sensors to be made inexpensively and in high volume with techniques standard to electronics manufacturing. The result is high-performance sensors that are inexpensive enough to put anywhere. Use of our technology will help us meet our future energy needs safely with clean hydrogen fuel.

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**For additional information:**

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