



Sensors

Advanced Gas Sensors and High-Temperature Pressure Sensors

For in situ leak detection, emissions monitoring, and pressure measurements

Innovators at NASA's Glenn Research Center have developed advanced hydrogen and hydrocarbon gas sensors capable of detecting leaks, monitoring emissions, and providing in situ measurements of gas composition and pressure. These compact, rugged sensors can be used to optimize combustion and lower emissions and they are designed to withstand harsh, high-temperature environments (e.g., silicon carbide (SiC) sensors can operate at 600°C). NASA Glenn is actively seeking industrial partners to develop and apply these cutting-edge sensors cooperatively in new applications.

BENEFITS

- Rugged - sensors function in environments where conventional sensor systems are inoperable
- Low cost - emissions sensors can replace more expensive gas measurements systems, and high-temperature SiC pressure sensors can eliminate the need for cooling
- Versatile - sensors can be used in a range of configurations, including wireless and Lick-and-Stick sensor systems
- Responsive - high-temperature SiC pressure sensor enables high-frequency pressure measurements in combustion environments
- Easy to install - Lick-and-Stick leak detection system can be applied wherever safety information is needed

technology solution

NASA Technology Transfer Program

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THE TECHNOLOGY

In conjunction with academia and industry, NASA's Glenn Research Center has developed a range of microelectromechanical systems (MEMS)-based and SiC-based microsensor technologies that are well-suited for many applications. The suite of technologies includes (1) hydrogen and leak detection sensors; (2) emissions sensor arrays; (3) SiC high-temperature pressure sensors; and (4) high-temperature contact pads for wire bond connections.

Currently used to protect astronauts on the International Space Station, the hydrogen and leak detection sensors have many Earth-based applications as well. They can function as a single-sensor unit or as part of a complete smart sensor system that includes multiple sensors, signal conditioning, power, and telemetry. The system can comprise sensors for hydrocarbons, oxygen, temperature, and pressure. The emissions sensor array features a gas-sensing structure that detects various combustion emission species (carbon monoxide, carbon dioxide, oxygen, hydrocarbons, and nitrogen oxides) over a wide range of concentrations. In addition, the emissions sensor array remains highly sensitive and stable while providing gas detection at temperatures ranging from 450 to 600°C, as does the SiC high-temperature pressure sensor. These new sensors provide a combination of responsiveness and durability that offers great value for a wide range of applications and industries.



The SiC pressure sensor performs successfully at temperatures as high as 610°C (following 1100 hr of high-temperature testing).



Lick -and -Stick leak detection system provides self-calibration and ready installation.

APPLICATIONS

The technology has several potential applications:

- Leak detection for hydrogen-powered vehicles
- Rapid inspection of valve and seal integrity
- Storage tank headspace monitoring
- System health monitoring
- Engine emissions monitoring and control
- Industrial process monitoring
- Safety monitoring
- Alarms for high-temperature pressure vessels and piping
- Fire detection and environmental monitoring
- High-frequency pressure measurements in combustion environments, for example, in-cylinder pressure measurements

PUBLICATIONS

Patent No: 7,518,234; 6,845,664; 6,291,838; 7,389,675; 8,052,854; 8,877,636; 8,001,828

Patent Pending

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