Semi-Conductor Method
Sensor: SG

Stationary sensor
Example: SG-8581

1. Brief description

This sensor uses a metal oxide semiconductor, which changes in resistance when it comes into contact with a detectable gas. The sensor detects this change in resistance as the gas concentration. It is a general-purpose sensor that detects all types of gases ranging from toxic gases to combustible gases.

Category	Detectable gas
Solid	Combustible / Toxic

2. Structure and principles

[Structure]

The sensor consists of a heater coil and a metal oxide semiconductor (SnO_2) formed on an alumina tube. The tube is equipped with two Au electrodes at its ends to measure the resistance of the semiconductor.

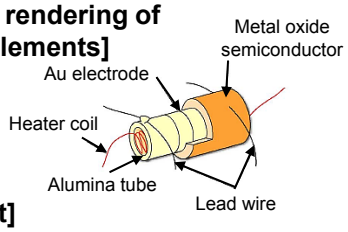
[Principles]

The heater coil heats the surface of the metal oxide semiconductor to 350 to 400°C. With atmospheric oxygen adsorbed on this surface in forms of O^- and O^{2-}, the semiconductor keeps a constant resistance. Then, methane gas or the like comes into contact with the surface and becomes chemisorbed by it, which is in turn oxidized by O^{2-} ions and separated. The reaction occurring on the surface of the sensor is represented as follows:

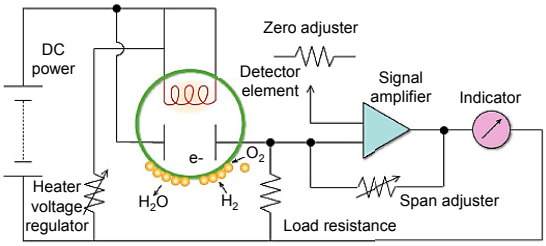
$$CH_4 + 4O^{2-} \rightarrow CO_2 + 2H_2O + 8e^-$$

In short, methane gas adsorbs on the surface of the sensor and takes the absorbed oxygen away; this increases free electrons inside the sensor, reducing the resistance. By measuring the change in resistance, the sensor determines the gas concentration.

[Conceptual rendering of the sensor elements]



[Drive circuit]

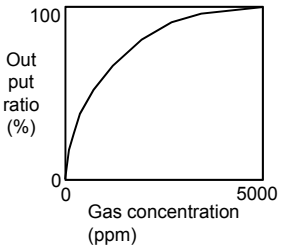


$$H_2 + O^{2-} \rightarrow H_2O + 2e^-$$

3. Features (of the sensor SG-8521 as an example)

○ Output characteristics

The sensor detects changes in the resistance of the semiconductor, meaning that it detects even low concentrations (ppm level) that cannot be detected by new ceramic-based sensors.
The sensor is highly sensitive with a high sensor output level for low concentrations.



○ Aging characteristics

The sensor maintains stability over the long term with a long life. Compared with the catalytic combustion-based sensor, this type sensor is highly resistant to toxicity and severe atmosphere.

○ Detection of toxic gases

Since, in principle, the resistance changes according to changes in the number of electrons and the electron mobility, the sensor detects a variety of gases, including toxic gases, which produce less combustion heat.

○ Gas selectivity

Adding an impurity to the semiconductor material changes the interference effect. This characteristic allows the sensor to selectively detect some gases.

4. Detectable gas, molecular formula, model, and detection range (examples)

Detectable gas	Molecular formula	Model #	Detection range
Solvents Combustible gases in general	-	SG-8511	0-5000 ppm
		SG-8521	
Hydrogen	H_2	SG-8541	0-200 ppm
Methane	CH_4	SG-8581	

5. Products of this type (examples)

○ Stationary products

... GD-A80V, GD-A80DV, GD-70D, SD-1GH, SD-D58·DC·GH

GD-70D