

CATALYTIC TYPE GAS SENSOR for FLAMMABLE GAS DETECTION No. HW-P03-07

FIS plans to release a highly reliable catalytic type gas sensor based on the precision processing technology.

Structure

The gas sensor has two elements: a detector (D-element) and a compensator (C-element) as shown in Fig. 1. These two elements are isolated with a heat separator. Both the elements have a platinum heater coil with the same specification. This coil has the double helix structure (coiled coil), which is the first introduced to catalytic type gas sensors in the world (Fig. 2). Various combustible gases are catalytically burned on the surface of the D-element which is heated at about 400°C. On the other hand, no catalytic burning occurs on the surface of C-element though it has the same other characteristics as D-element, such as thermal capacity, etc. Therefore, C-element will compensate environmental temperature change for the D-element output.

Coiled coil

It has been pointed out as disadvantage of catalytic gas sensors that physical impact and vibration cause the heater coil break and zero-level drift. To improve this, the coiled coil type heater has been developed. The coiled coil has the shock absorption structure by supporting both edges of the bead with the spring shaped leads. The conventional single coil catalytic gas sensor has the zero-level drift which is equivalent to 2000ppm of methane in the mechanical shock test. However, it is confirmed that this drift for the coiled coil gas sensor will be within 100ppm. Also the effective length of coiled coil can be longer than the conventional single coil. Therefore, the higher voltage can be supplied to the heater than the conventional sensor. As a result, the common voltage of 5.0V to the control circuit can be used as a power supply.

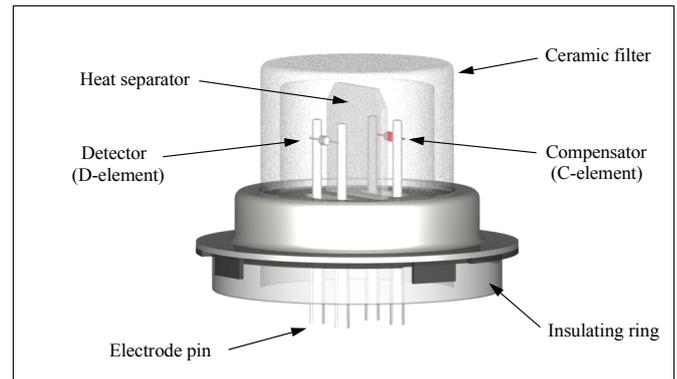


Fig. 1 Configuration

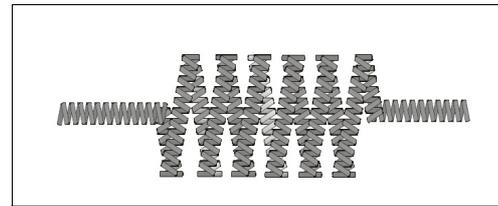


Fig. 2 Coiled Coil

Ceramic housing

The external housing consists of alumina type ceramics and high corrosion resistance metal only. Therefore, the sensor can be placed in the sever atmospheric conditions where the conventional sensor cannot be installed. For electrode pins, Nickel is welded to Hastelloy so that the sensor can be directly soldered to PCB.

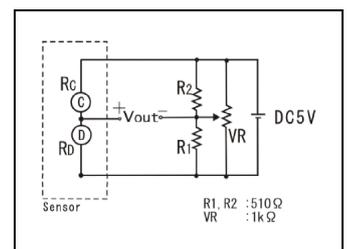


Fig. 4 Standard circuit

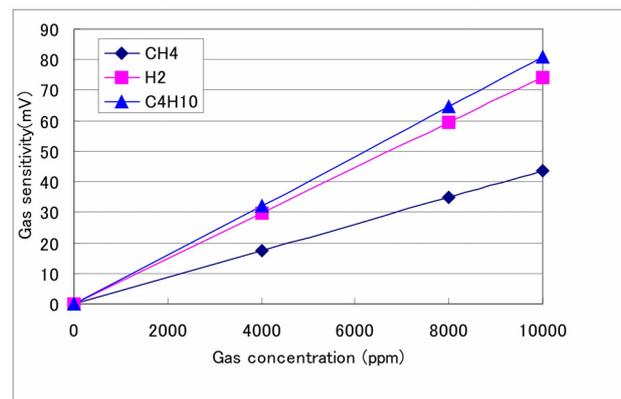


Fig. 3. Sensitivity characteristics

Catalytic type gas sensor

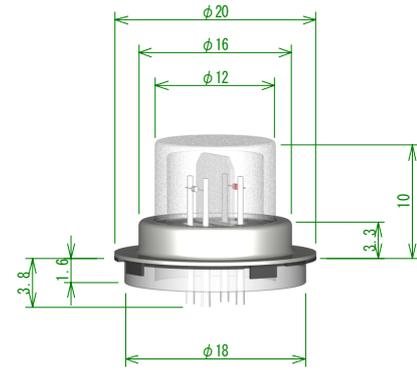
Gas sensitivity characteristic

The catalytic type gas sensor shows a linear output to the gas concentration as shown in Fig.3. The detection range is 1-100%LEL of each gas. But the lowest detection level may be 300ppm from the view point of actual environmental factors. Also, on the side of high concentration, the linearity may not be expected for any gas if the gas sensitivity output voltage (= output in gas - zero level output) exceeds 100mV.

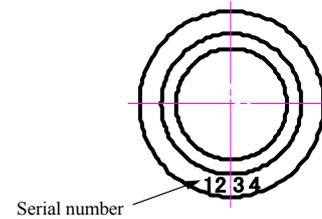
Operation circuit

Both the D-element and C-element can be considered as electric resistors. The sensor is operated through a bridge circuit as shown in Fig. 4, with additional two fixed resistors and one variable resistor. In Fig. 4, the variable resistor is used to adjust the center voltage for keeping the zero-level constant. The variable resistor can be connected to the fixed resistors in series. In this case, please note that the zero-level adjustment value per variable resistor's adjustment angle will be large. The cermet type variable resistor is recommendable to secure the long-term stability (e.g. FT-6 manufactured by Copal).

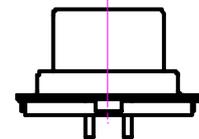
Dimensions



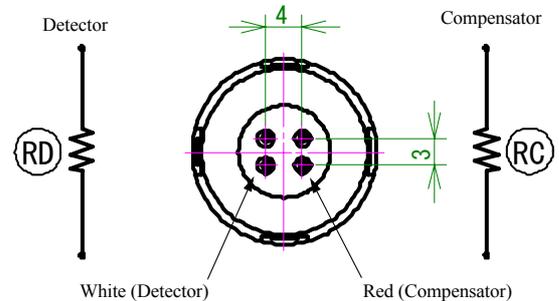
Scale: mm



Serial number



4-φ1



White (Detector)

Red (Compensator)

Specifications

A. Standard Operating conditions

| Symbol | Parameter | Specification | Conditions etc. |
|--------|----------------|----------------|-----------------------|
| Vin | Supply voltage | 5.0 VDC ± 0.1v | Bridge supply voltage |
| Ic | Current | 80 mA | Typical value |

B. Environmental conditions

| Symbol | Parameter | Specification | Conditions etc. |
|--------|-----------------------|------------------|--------------------------|
| Tao | Operating temperature | -20°C to 400 °C | Without dew condensation |
| Tas | Storage temp | -20 °C to 100 °C | |
| RH | Relative humidity | Less than 95% RH | |

C. Sensitivity characteristics

| Model | HW-P03-07 | | |
|---------------|-------------------|------------------|---------------------|
| Symbol | Parameter | Specification | Conditions etc. |
| Vout | H2 4000ppm | 25 to 35 mV | -20°C 65%RH |
| | CH4 4000ppm | 15 to 30 mV | |
| | i - C4H10 4000ppm | 25 to 40 mV | |
| Response Time | | within 5 seconds | 90% Stability level |

E. Parts and Materials

| No | Parts | Materials |
|----|-----------------|---|
| 1 | Element | Catalyst |
| 2 | Coiled coil | Platinum (Pt) |
| 3 | Ceramics filter | Alumina (Al ₂ O ₃) |
| 4 | Electrode pin | Hastelloy covered with Nickel |
| 5 | Ceramics base | |
| 6 | Ring | Hastelloy |

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