

CH₄ sensor using MEMS technology for battery operation

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Town gas leak detectors have contributed to a decrease in town gas accidents. However, the market penetration of town gas leak detectors has stagnated at an insufficient level. One of the main factors causing this stagnation is that, since CH₄ is lighter than air, gas detectors must be installed near the ceiling. Since currently available gas detectors require AC power, detector installation requires special wiring in the ceiling. To eliminate this barrier to easy installation, a battery operated town gas leak detector is strongly required. To realize a battery operated gas leak detector, Figaro has been developing a CH₄ sensor using MEMS technology. This MEMS device has a suspended air-bridge structure, which has the advantage of low power consumption and very fast thermal response speed. In addition, Figaro has succeeded in shortening the sensor resistance stabilization time in air after heater-on by applying SnO₂ supported Pt. By combining these MEMS and sensing material technologies with intermittent heater driving (heating cycle of 30 seconds, with heater-on time of 0.1 seconds), a 5-year product life with a lithium battery has been realized.

The main interference gases for a town gas leak detector are H₂ and alcohol. Sensitivity to H₂ is reduced by increasing the sensing film thickness and decreasing the porosity composed of secondary grains. With this structure, interference gases will more readily combust before reaching the sensing material located between the electrodes where it can affect sensitivity. Similarly, the electrode layout will also influence selectivity. Electrodes limited to the center of the sensor element (Fig. A) are less sensitive to H₂ and alcohol compared with electrodes which extend throughout the entire sensor element (Fig. B) because interference gases must travel a longer distance to reach the electrode (and are therefore more likely to combust before reaching the electrode). As a result, a MEMS sensor with the electrode situated in the center of the sensing element has good selectivity.

