Introduction to Pellistor Gas Sensors

DESCRIPTION

Pellistors are solid-state devices used to detect gases which are either combustible or which have a significant difference in thermal conductivity to that of air. The detecting elements consist of small ‘pellets’ of catalyst-loaded ceramic whose resistance changes in the presence of the target gas hence the term ‘pellistor’ being a combination of ‘pellet’ and ‘resistor’.

To detect these gas types there are two types of pellistor, Catalytic and Thermal Conductivity (TC), operating in different modes.

The catalytic type sensor works by burning the target gas; the heat generated producing a change in the resistance of the detecting element of the sensor proportional to the gas concentration. The vast majority of pellistor production is of the catalytic type.

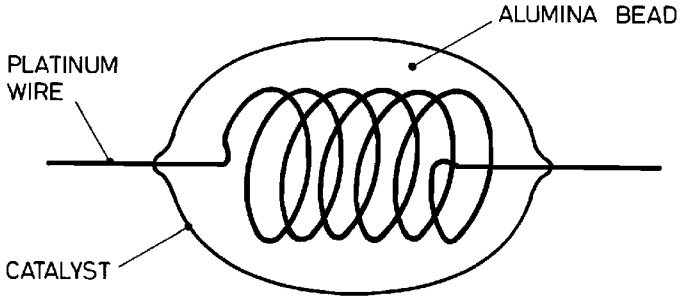
The TC sensor works by measuring the change in heat loss (and hence temperature/resistance) of the detecting element in the presence of the target gas.

HISTORY

Prior to the development of Catalytic gas sensors, combustible gases were most often measured using flame safety lamps. These lamps, although giving an indication of the gas concentration, were not capable of a high level of accuracy or being easily able to be incorporated into a detection system capable of giving visual and audible alarms.

The earliest form of catalytic gas sensor used heated bare coils of platinum wire to burn the gas. The heat generated by the burning process produced a change in the resistance of the coil. This change was measured using a simple Wheatstone bridge circuit. The low catalytic activity of the bare coil necessitated having to run the coils at high temperatures (800 – 1000 °C) to be able to oxidise the target gas (methane). At these temperatures it was found that significant evaporation of the wire was taking place. This produced a reduction in the wire diameter and a subsequent change in the resistance. This produced a significant level of zero drift and a lifetime of as short as several days.

Work was carried out in the early 1960s, primarily at the UK Safety in Mines Establishment, to produce a catalytic sensor, which had a much-improved lifetime and reduced zero drift. This work involved replacing the limited catalytic activity of the platinum coil by the much greater activity of a finely divided high surface area catalytic layer. This layer was laid down on a ceramic bead that contained a platinum coil acting again as the heater/calorimeter. In this design the catalytic layer only needed to be heated to ~500 °C. This vastly reduced the degree of evaporation of the platinum coil, hence improving the stability and also reducing the amount of power required to run the sensor. This allowed sensors to be fitted into portable battery-powered equipment having an acceptable battery lifetime. This type of pellistor design is still used today.



The design has been modified to reduce the amount of power used by the sensor and to make the sensor more resistant to poisoning and mechanical shock. e2v, when known as EEV, was in the forefront of these developments and the current range of pellistors incorporates the design improvements.

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PELLISTOR PROTECTION

As described above, pellistor beads are run at high temperatures. These beads can act as an ignition source in explosive atmospheres. This is prevented by enclosing the beads in an enclosure that does not allow ignition of the gas around the sensing beads to be transmitted to the bulk of the gas. Gas is allowed to diffuse into the sensor via a permeable sinter of specified porosity. The protection concept is known as ‘Flameproof’. The design of these enclosures has to meet the requirements of the relevant standards, EN50018 or the latest standard, EN60079. Designs meeting these standards are known as ‘Certified’.

e2v PRODUCTS

e2v manufactures a wide range of pellistors. These can be supplied either as pellistor bead pairs (which are then placed in the customer’s certified enclosure) or within a certified enclosure (VQ500 for portable systems and VQ600 for fixed systems).

The catalytic pellistors can be either be poison or non-poison resistant and may also be made to be sensitive to combustible gases, including or excluding methane.

Both Catalytic and TC pellistors are available with a variety of working voltages and power levels. In general, the higher power devices are used in fixed systems and the lower versions in portable equipment. Low power pellistors are also available with the option of shock protection.

Finally, bead pairs are available with fixed or flexible leads. The lead terminations on the VQ500 and VQ600 are via pins and flexible leads respectively.

Further information can be obtained from the list of pellistor datasheets or from the product selector on the website.