FAQ Series July 7, 2008

WHAT IS THE DIFFERENCE BETWEEN CATALYTIC & INFRARED?

Combustible Gas Detection

In detecting combustible gases in oil and gas, petrochemical and other applications, choosing between the two most common gas sensing technologies used for this purpose will be critical in ensuring a safe, reliable and cost effective solution. These technologies are catalytic combustion and infrared. Both have advantages and disadvantages depending on an application's specific needs.

RKI Instruments, a world leader in gas detection equipment, offers both technologies, providing the user with flexibility in selecting the best sensing technology for their situation. Of the many hydrocarbons that are found in industry today, most are detectable with a catalytic combustion sensor and many are detectable with an infrared sensor. It is important to consider the specific compounds to be monitored as there are some that do not readily lend themselves to detection with a general purpose infrared (IR) detector, such as hydrogen, acetylene, and aromatic compounds, like benzene and toluene, for example. We will look at some common compounds and discuss the basic principles of operation for the two technologies as well as their advantages and disadvantages.

Typical alkane gases monitored	Other alkenes, alcohols, and amines monitored
• Methane • Ethane • Propane • Butane • Pentane • Hexane	• Butadiene • Isopropylamine • Propylene • Ethylene Oxide • Propylene Oxide • Ethanol • Methanol

Catalytic Detectors

Catalytic detectors are based upon the principle that when gas oxidizes it produces heat, and the sensor converts the temperature change via a standard Wheatstone Bridge-type circuit to a sensor signal that is proportional to the gas concentration. The sensor components consist of a pair of heating coils (reference and active). The active element is embedded in a catalyst. The reaction takes place on the surface of the catalyst, with combustible gases reacting exothermically with oxygen in the air to raise its temperature. This results in a change of resistance.

There is also a reference element providing an inert "reference" signal by remaining non-responsive to gas, thereby acting as a stable "baseline" signal to compensate for environmental changes which would otherwise affect the sensor's temperature.

Advantages

The major advantages of catalytic detectors:

- Robust.
- Simple to operate.
- Easy to install, calibrate and use.
- Long life with a low replacement cost.
- Proven technology with exceptional reliability and predictability.
- Easily calibrated individually to gases such as hydrogen which cannot be detected using infrared absorption.
- Can perform more reliably in dusty & dirty atmospheres as they are not as sensitive as optics to the build up of industrial contaminants.
- Can perform more reliably in high temperature applications.
- Are less sensitive to humidity and condensation.
- Not as significantly affected by changes in pressure.
- Can detect most combustible hydrocarbons.

Disadvantages

The limiting factors in catalytic detector technology:

- Catalysts can become poisoned or inactive due to contamination (chlorinated & silicone compounds, prolonged exposure to H2S and other sulfur &/or corrosive compounds).
- The only means of identifying detector sensitivity loss is by checking with the appropriate gas on a routine basis and recalibrating as required.
- Requires oxygen for detection.
- Prolonged exposure to high concentrations of combustible gas may degrade sensor performance.
- If flooded with a very high gas concentration, may show erroneously low or no response, and sensor may be damaged or rendered inoperable.

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Infrared Detectors

The Infrared (IR) detection method is based upon the absorption of infrared radiation at specific wavelengths as it passes through a volume of gas. Typically two infrared light sources and an infrared light detector measures the intensity of two different wavelengths, one at the absorption wavelength and one outside the absorption wavelength. If a gas intervenes between the source and the detector, the level of radiation falling on the detector is reduced. Gas concentration is determined by comparing the relative values between the two wavelengths. This is a dual beam infrared detector.

Infrared gas detection is based upon the ability of some gases to absorb IR radiation. Many hydrocarbons absorb IR at approximately 3.4 micrometers and in this region H2O and CO2 are relatively transparent. As mentioned earlier, there are some hydrocarbons and other flammable gases that have poor or no response on a general purpose IR sensor. In addition to aromatics and acetylene, hydrogen, ammonia and carbon monoxide also cannot be detected using IR technology with general purpose sensors of 3.4 micron specifications.

Advantages

The major advantages of IR gas detectors:

- Immunity to contamination and poisoning.
- Consumables (source and detector) tend to outlast catalytic sensors.
- Can be calibrated less often than a catalytic detector.
- Ability to operate in the absence of oxygen or in enriched oxygen.
- Ability to operate in continuous presence of gas.
- Can perform more reliably in varying flow conditions.
- Even when flooded with gas, will continue to show high reading and sensor will not be damaged
- Able to detect at levels above 100 % LEL.

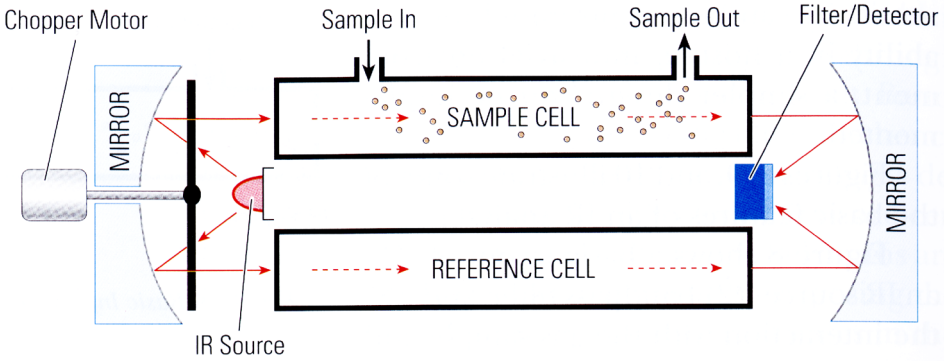
Disadvantages

The limiting factors in IR technology:

- The initial higher cost per point. IR detectors typically are more expensive than catalytic detectors at initial purchase.
- Higher spare parts cost.
- Gases that do not absorb IR energy (such as hydrogen) are not detectable.
- High humidity, dusty and/or corrosive field environments can increase IR detector maintenance costs.
- Temperature range for detector use is limited compared to catalytic detectors.
- May not perform well where multiple gases are present.

Conclusion

There is clear need for both IR and catalytic detectors in industry. When making a choice, be sure to consider the field environment and the variables in detector design. Life-cycle cost assumptions will not hold true in all environments. The same can be said for detector mean-time-to-repair or failure. Careful analysis of detectors, suppliers and field experience will help you to select the best catalytic or IR detectors for your application.



IR Sensor

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