Infrared vs. Catalytic Bead Technology: Pros & Cons

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"We need the highest level of protection and lowest long-term cost of ownership. Do I use infrared or catalytic bead technology to detect combustible gases?" These are questions I hear often from customers when they're trying to decide what technology to employ in their pursuit of the best gas detection environment for their industries.

Historically, catalytic bead technology has dominated the market. It is inexpensive to manufacture, and if properly designed offers excellent T50 and T90 response times to the target gases. It is a proven design that has been around for years utilising the Wheatstone Bridge principle. In layman's terms, it essentially measures the resistance created when the active bead is exposed to gas, thereby causing the bead to rise in temperature as it burns the gas. This creates a resistance which is then compared to the reference bead that is impervious to the atmosphere. The amount of gas concentration is linear with the resistance (the more resistance the higher the gas concentration).

There are some positive advantages to catalytic bead technology. While the cost of catalytic bead sensors is low, the most important advantage is the versatility of the catalytic bead's range of gas detection. This sensor technology has the ability to detect most combustible gases including hydrogen. In short it will detect most hydrocarbon and non-hydrocarbon combustible gases. But as good as catalytic bead technology is, there are a few disadvantages that one must understand. First catalytic bead sensors are susceptible to poisoning from silicates that can attach to the active bead over time and create a coating which will make it resistant to the atmosphere. The result is a detector that will provide a 4ma output but is not detecting gas, creating false sense of security. This is why it's imperative to perform quarterly, zero and span calibration.

The second common disadvantage with catalytic bead technology is oversaturation from high concentrations of gas. High concentrations of gas or levels above 100% LEL can damage a sensor unless some method is employed to protect the catalytic bead sensor once it has gone into an over-range state. Another potential result of oversaturation is displacement of oxygen which causes the sensor output to decrease, thereby creating a perception that gas levels are lowering when in actuality you have an enriched environment. Lastly, a major drawback is that catalytic bead sensors will need to be replaced periodically. Due to all of these potential environmental risks to the sensor, catalytic bead technology demands that one must zero and span calibrate their instruments routinely to ensure they are operating properly. At Oldham we recommend quarterly calibrations as the minimum standard to ensure the equipment is operating properly and providing the level of protection people deserve.

While combustible infrared sensors are not new to the market, they have really gained in popularity in the last five to ten years as the technology has improved. Modern infrared technology addresses most of the shortcomings of catalytic bead with few exceptions. Combustible IR detectors operate on a principle of gas absorption utilising an IR light source along with a measurement and reference detector. For this discussion this is the base design technology considering that there are some sophisticated optical designs and advanced algorithms used to ensure reliable results which vary among manufacturers. In simple terms, the detectors have two wave lengths: one which will absorb gas, and the reference which will not. The signal strength is measured on the active wave length and then compared to the reference. This information is entered into algorithms and provides a linearised output of the gas concentration.

There are many advantages to this technology. First, one cannot oversaturate the sensor. High concentrations of gas have no effect on a IR detector. Second, most if properly designed demand fewer calibration intervals if any. Some only require a bi-annual or annual zero check with no span calibration required. Maintenance is greatly reduced with the infrared but not nonexistent. Third, infrared detectors are immune to poisoning such as silicates or high concentration of H2S that will damage a catalytic bead sensor. Fourth, they are highly reliable and almost failsafe. Modern infrared detectors in general will inform you when there is a problem such as obscuration of the light source, light source failure or detector failure. The chance of detector failing and providing a zero or 4ma is almost impossible.

The drawback is that infrared detectors typically have higher upfront costs. They can only detect hydrocarbons and will not detect exotic chlorinated or fluorinated hydrocarbons, for example. The technology will also not detect hydrogen. IR detectors are essentially gas specific and each detectable hydrocarbon has it own unique gas curve. The output is linear for that specific gas at the full range and over a temperature curve. For a general hydrocarbon detector one must understand all the potential gases they need to detect and determine with their supplier if the detector will detect all the gases on the safe side of the combustion curve.

Both of these technologies present pros and cons that must be weighed in the application, the environment and the cost of ownership specific to each customer. Ensure that you select the best technology for your application by choosing gas detection experts to advise and assist you.

About the Author

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Keith has P&L responsibility for Oldham Americas, a subsidiary of Industrial Scientific Corporation, Oldham specialises in area monitoring solutions for flame, hazardous gases and related dangers in the workplace. Prior to Keith's current role he served at Industrial Scientific Corporation as Global Account Manager in the Petrochemical, Pulp and Paper and Utilities industries. Keith began his career at Vallen Safety Supply and was promoted to Branch Manager of the Anchorage Alaska office. Later he became Director of Safety Products and Services at Wilson Supply. He then held leadership positions in sales with Scott Instruments, Regional Sales Manager and Western Zone Manager and Honeywell Analytics, Director of Sales, North America.
Keith earned his Bachelors of Business Administration in Marketing from Texas A & M University in College Station Texas. He is an active member in several professional organisations in support of life safety.