

Latest FTIR Innovation Eliminates the Gap in Gas Identification



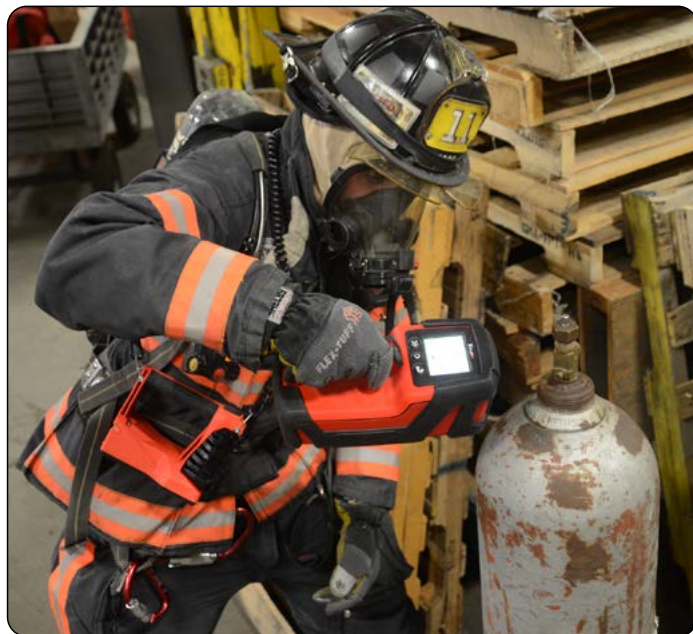
When responding to a Hazmat incident, knowing what you're dealing with is key to keeping people safe and effectively dealing with the situation.

The Gas Identification Gap

Once you identify a material, the hazards and properties of that material are readily at your fingertips. For solids and liquids there are many tools available for identification of unknowns. Led by the "white powder" scares of the early 2000's, FTIR and Raman instruments have been developed which can quickly and easily identify thousands of unknown solids and liquids. Many Hazmat teams worldwide have successfully used this equipment, providing identification of unknowns and improving the safety of their community.

In contrast to solids and liquids, though, there has been a real gap in the ability of instruments to identify unknown gases for Hazmat response. By their very nature, gases exist at lower concentrations, making identification more difficult. Unfortunately, gases pose the greatest danger in emergency response. They can be toxic at low concentrations, and they are uncontained. To describe the danger in common terms, "They can come out and get you".

Infrared spectroscopy can fill the gas identification gap for gases, similar to what it has done with solids and liquids. Redwave Technology, a leader in portable identification technology, first addressed the ThreatID GLS. In the next advancement, Redwave has developed the XplorIR specifically for this need. The XplorIR combines the latest advancements in infrared instrumentation with cutting edge mathematical algorithms to accurately identify over 5500 different gases at low concentrations, all in a compact, handheld package. It allows confident, quick identifications of gases downrange, at their source.



Detection vs Identification

First responders have many tools to detect and quantify gases. Combustion gas indicators (CGI), photo ionization detectors (PIDs) and chemical specific sensors (such as a 4 or 6 gas meter), all indicate if certain gases are present and predict a concentration, but none of them actually identify the material. The PID is a great example. It is highly sensitive, and it can detect a wide variety of gases. With the proper calibration it can also accurately quantify many gases. Teams love using the PID because it can see so many different materials. This universal nature is both its advantage and its downfall. If there is a gas present, most likely the PID will respond, telling you something is there. Unfortunately, you still don't know what is there. What are the dangers? How much of it is a problem? How do you remediate it? The PID lets you find it but doesn't tell you what it is. Pairing the PID with the XplorIR gives the ability

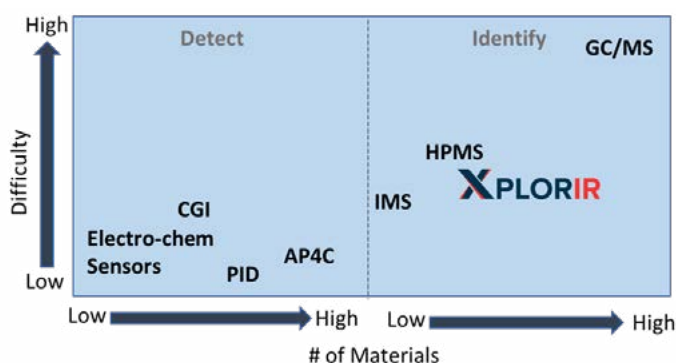


to quickly detect and locate the gas of interest (using the PID), as well as accurately identify the material (using the XplorIR). Additionally, once the identification is made with the XplorIR, the correct calibration factor can be entered into the PID, allowing for accurate quantitative measurement.

Chemical specific electrochemical sensors and flame ionization spectrometers are more specific than CGI or PID detectors, but their identification abilities are still limited. Electrochemical sensors are targeted at specific compounds, such as hydrogen sulfide or carbon monoxide; however, they have cross reactivity to other compounds as well. A positive reading is indicative of the gas present, but not a real identification. Flame spectroscopy detectors (FSD) are more specific than PID's. Commonly used handheld models respond to compounds containing arsenic, nitrogen, sulfur and phosphorous. Similar to the electrochemical sensors, this allows classification but not identification.

Other instruments provide identification for specific threats; however, the XplorIR provides the largest coverage of commonly found gases at relevant concentrations. Ion mobility spectroscopy (IMS) and high-pressure mass spectrometry (HPMS) both provide sensitive detection of specific, targeted threats. Both are important tools for the detection and identification of CWA's and dangerous narcotics. For general use, though, they present some issues. First, the number of materials identifiable by these systems

is quite low. IMS are very sensitive, but they're targeted at CWA and a few select toxic industrial chemicals (TIC's); they provide identification or classification of approximately 50 compounds. HPMS is more versatile, covering CWA, TICs and many narcotics. Each of these can be detected with great sensitivity, but the number of compounds identified is on the order of several hundreds. By comparison, the XplorIR has over 5500 compounds in the library covering a wide range of TICs and volatile organic compounds (VOCs). This allows simple identification of many substances found on typical hazardous materials calls. Its continuous monitoring mode and handheld size further enhance its usability by allowing identification of the gas at the source with no sampling or pre-concentration needed.



Sensitivity vs Usability

An instrument with high sensitivity can accurately identify even a small amount of material. Obviously, high sensitivity is advantageous when dealing with hazardous materials. Making an identification at a low concentration helps to keep both responders and the public safe. Sensitivity can have a downside as well, because the system can be easily contaminated with too much sample. The XplorIR can identify most compounds at concentrations in the part per million (ppm) range. Additionally, with partial filling of the gas cell, it can identify compounds over 3 orders of magnitude. As an example, ammonia can be accurately identified at concentrations ranging from 25 ppm to over 0.5%. This gives the ability to identify and address both small and large problems. The continuous monitor mode detects the presence

of a gas and automatically identifies it; this provides the answer as quickly as possible without overloading the system. Even high concentrations can typically be pumped clean in less than a minute; there is no need to conduct an extensive cleaning, or “bake-out”, procedure.

Small Molecules

Absorbances measured by infrared spectroscopy is based on covalent chemical bonds present in the sample and consequently is unaffected by the molecular weight of a sample. There is no limit, either high or low, to the sample molecular mass which can be measured by infrared. Mass spectrometers, on the other hand, have a molecular weight range for which they are effective. In particular, the minimum molecular weight measurable by most portable mass spectrometers is approximately 50 atomic mass units.

Many hazardous gases which have low molecular weights are identifiable by the XplorIR, but not by commercially available mass spectrometers. Examples include ammonia (17 amu), diborane (27 amu), formaldehyde (30 amu), hydrogen cyanide (27 amu), carbon monoxide (28 amu) and phosphine (36 amu). All of these gases are listed by the Occupational Safety and Health Administration (OSHA), as hazardous industrial gases and are identifiable by the XplorIR.

Simple Use, Important Results

The XplorIR allows for easy identification of many gas phase chemicals. By extending well accepted infrared spectroscopy identification to gases, the XplorIR allows responders to increase safety and improve response to chemical gases and vapors which represent one of the larger dangers which they deal with. Overall, the system can identify over 5,500 gases, providing the broadest range of gas identification available.



XPLORIR