Improving Gas Analysis

The Importance of Dewpoint Analysers and Their Resistance to Contamination

Dewpoint and moisture analysis is critical for health and safety in many applications. The interaction of oxygen, or acidic gases, and water vapour can create an aggressive mixture causing high rates of corrosion to pipe work and plant. There is only one thing worse than not monitoring dewpoint, and that is to have an analyser that does not alert operators to high moisture levels and gives them a false sense of security.

Fig. 1

Fig. 1 shows the fire following a gas pipe rupture in the USA. To give some idea of scale the silhouette of bridge supports can be seen. 12 people died in the explosion, if this had happened in a residential or industrial area the resulting disaster would have been far greater. The underground pipe explosion created a crater 51 feet in diameter, with a 49 feet section of the pipe being ejected from the crater. The investigation found that the cause was “internal corrosion of the gas pipe”.

Apart from corrosion issues, “wet”, high pressure natural gas can rapidly form hydrates (*Fig. 2*) that can partially or totally block a pipe-line system, and can take days, weeks, and sometimes months to remove, during which time the loss of revenue can run to £Ms.

Fig. 2

Most sensors with the sensing surface exposed to the sample gas can loose sensitivity, or become much slower to respond when in contact with wet acids and other contamination, and there have been instances where a catastrophic plant failure has been pre-empted by a small amount of moisture in a process gas. This small moisture event, when combined with a corrosive gas, has poisoned the moisture sensor and led to the moisture analyser missing a much larger and more significant event a short time later. When dealing with pressurised gases that contain oxygen, H_2S, chlorine, ammonia or other acidic gases, it is important to ensure that sensors are regularly checked.

A Comparison of Techniques

IMA are able to supply the widest range of moisture analysers available, and by doing so, are able to suggest the best analyser for a particular task. Until recently, all on-line systems have exhibited only a small degree of tolerance to contamination, and for critical measurements we ask:

”*Why have a measurement system to warn against moisture that can also be poisoned by high moisture levels*?”

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Where corrosive or aggressive gases are concerned, most process analysers require frequent calibration checks to compensate for loss of sensitivity, caused either by contamination or sensor drift. Natural gas in particular presents additional problems with some analysers influenced by methanol injection, or glycol and amine carry-over.

Conventional sensors are regularly returned for re-calibration or re-coating; in some cases this can be as frequently as every 3 or 4 weeks. Using a tunable diode laser (TDL), is proving to have a high resistance to various forms of particulate and chemical contamination.

The SS2100 from SpectraSensors uses a TDL making an accurate, non-contact, measurement of water vapour, carbon dioxide, and other gases, offering significant advantages in terms of speed of response and maintenance requirements, resulting in greater cost efficiencies, and improved safety for many process control applications.

The SS2100 analyses how much light at a specific wavelength is returned after passing through the sample environment, compared to the amount of light returned at a non-sensitive wavelength. The key to this is being able use a precise and spectrally narrow light source so that water vapour (or the target gas) is the only molecule absorbing light. The amount of light absorbed by the gas space is proportional to the concentration of the target gas present.

The quality of measurement of surface techniques, such as aluminium oxide (Al_2O_3), phosphorous pentoxide (P_2O_5), quartz crystal or chilled mirror systems, can rapidly degrade when exposed to the various contaminants commonly present in process gases.

With TDL systems both the laser and the detector are mounted behind a window so the measurement devices do not come into contact with the sample gas, and non-contact systems such as the SS2100 offer many benefits for the user over "surface" sensor techniques.

The table below shows the impact of contaminants on the various techniques.

Contaminant	Al_2O_3	P_2O_5	Quartz Crystal	Chilled Mirror	SS2100 Laser
Methanol vapour	* † ⊗	* † ⊗	* ⊗	⊗ †	✓
Glycol vapour	* † ⊗	* † ⊗	† ⊗	† ⊗	✓
Amine vapour	* † ⊗	* † ⊗	† ⊗	† ⊗	✓
Mercury vapour	•	†	✓	✓	✓
H_2S Vapour	•	•	•	•	✓
HCL Vapour	•	†	•	•	✓
Chlorine vapour	•	†	•	•	✓
Ammonia vapour	•	•	•	•	✓

✓ = analyser unaffected
† = increased frequency of calibration/cleaning required
• = can severely effect or permanently disable the sensor
* = slows response of sensor
⊗ = can cause inaccurate readings

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