

Application Note

Moisture Measurement in the Packaged Gas Quality Control Laboratory HALO-500-H₂O

Introduction

Save time and money. Use the modern measurement techniques of Tiger Optics' 21st Century Spectroscopy to improve throughput in gas cylinder testing.

Background

The primary function of a quality control (QC) laboratory is to identify and quarantine unacceptable product before it leaves the production facility. To this end, the gas within each container is analyzed for a specified list of impurities of interest. Comparison of the measured values against the maximum allowable amount (typically parts per million) yields a pass or fail verdict for the product. Some of the most commonly specified impurities in pure gas products are nitrogen, oxygen, hydrogen, carbon dioxide, carbon monoxide, total hydrocarbons, and moisture. While most gaseous impurities can be swiftly quantified by using gas chromatography (GC), some impurities – including moisture – demand alternative solutions.

Moisture analysis is fraught with difficulty due to water's relatively low vapor pressure, high affinity for most solid surfaces, and temperature-dependent behavior in typical lab conditions. To alleviate these challenges, moisture measurement is almost always performed using an instrument specifically

designed for the purpose. Historically, these instruments have been based on principles involving moisture interactions with solid surfaces; once equilibration is achieved, a characteristic aspect of the moisture-surface interaction is measured. Not surprisingly, the time involved with this technique frequently causes moisture analysis to be singled out as the "bottleneck" in pure gas product QC.

Like any unit in a production environment, the QC lab works to maximize productivity and minimize costs. Cost savings are achieved by minimizing the gas consumed per analysis and maximizing the number of packages analyzed per shift. Increasing the number of analyses per shift is accomplished by various means: reducing the time needed for calibration checks, cutting the analysis time for each package, minimizing time between analyses, and seeking alternative solutions for bottleneck points, such as moisture measurement.

Solution

The HALO-500-H₂O moisture analyzer (Figure 1) is designed with the needs of the QC lab in mind. Tiger Optics' HALO-500 offers the user outstanding accuracy, specificity, and reliability, paired with improvement in response speed, gas consumption, and the capability to switch among a number of base gases.

Accuracy is clearly the first consideration for moisture measurements in a QC environment. The HALO-500's demonstrated accuracy is 0.01 ppm or 4 percent of reading over the entire 0.02- 500 ppm measurement range, making it the most accurate wide-range moisture instrument on the market. With a single device, the technology quantifies moisture in samples from basic grades to ultra-high purity products. Also, because the HALO-500's measurement is based on narrow bandwidth near-infrared spectroscopy, there is never a concern of false positive readings due to interfering species.



Figure 1. Tiger Optics HALO-500-H₂O Analyzer

Unlike aluminum oxide and piezoelectric-based sensors, whose measurements can be marred by interaction of other molecules on the sensor surface, the HALO-500 demonstrates extraordinary specificity by detecting a spectroscopic signal exclusive to the moisture molecule. The QC analyst can have complete confidence that the HALO-500's result directly correlates to moisture in the sample. An additional benefit comes from the HALO-500's underlying spectroscopic measurement technique that requires no periodic zeroing and spanning. The HALO-500's inherently stable internal calibration offers analysts ease of use as well as the

benefit of converting “calibration” time into “up” time for analyzing product.

The HALO-500 is engineered with a focus on pushing the limit of response speed for moisture measurement. The instrument's wetted parts are 316L stainless steel (Hastelloy® option available) with a 10 Ra surface finish and no moving parts. When paired with its low-wetted volume (< 75 cc's), the HALO-500 beats competitive technologies with an industry-leading 3 minutes to 95 percent of a sample reading. Switching between two relatively dry samples is even faster, on the order of seconds rather than minutes. The HALO-500 surpasses the advertised performance of a competitive technology that pledges only “65 percent of steady state reading in less than 5 minutes.”

Even a transition between base gas matrices is practically seamless, as the measured spectroscopic moisture signal remains unchanged in hydrogen, nitrogen, helium, oxygen, carbon monoxide, carbon dioxide, argon, neon, krypton, xenon, and clean dry air. The instrument is able to reach a stable reading as quickly as the new base gas can flow through the measurement cell. Fast measurement also provides the added benefit of less gas consumption, which is particularly critical for expensive rare gas samples.

In summary, the features of the HALO-500 offer the QC lab the opportunity to truly improve productivity while producing the highest quality data with absolute confidence.