

Jetalon GS-88™ Vapor Hydrogen Peroxide Monitor Case Studies

GS-88™ monitors the key physical properties of VHP (Vapor Hydrogen Peroxide) during processing in situ and real-time:

- VHP concentration
- Dew Point
- Micro-Concentration (μ Concentration) of condensate
- VHP temperature

The case studies below demonstrate these features.

iGS-88™ Operational Principle: Micro-condensation and Reflected Light Signal

The GS-88 monitor heats and cools a sapphire window that is exposed to the chamber containing VHP while illuminating the window. Jetalon's SRSensor™, a photo diode array, records the changes in the light signal as it reflects off the window and condensate. Changes in the reflected light signal are due to changes in the concentration of the condensate and are an accurate measurement of micro-condensation, while fluid temperature, dew point and concentration are also recorded. Cycling the window temperature clears the glass; recording the onset of condensation is rapidly repeatable.

Figure 1 shows Onset of Condensation is taking place at about 24 degrees.

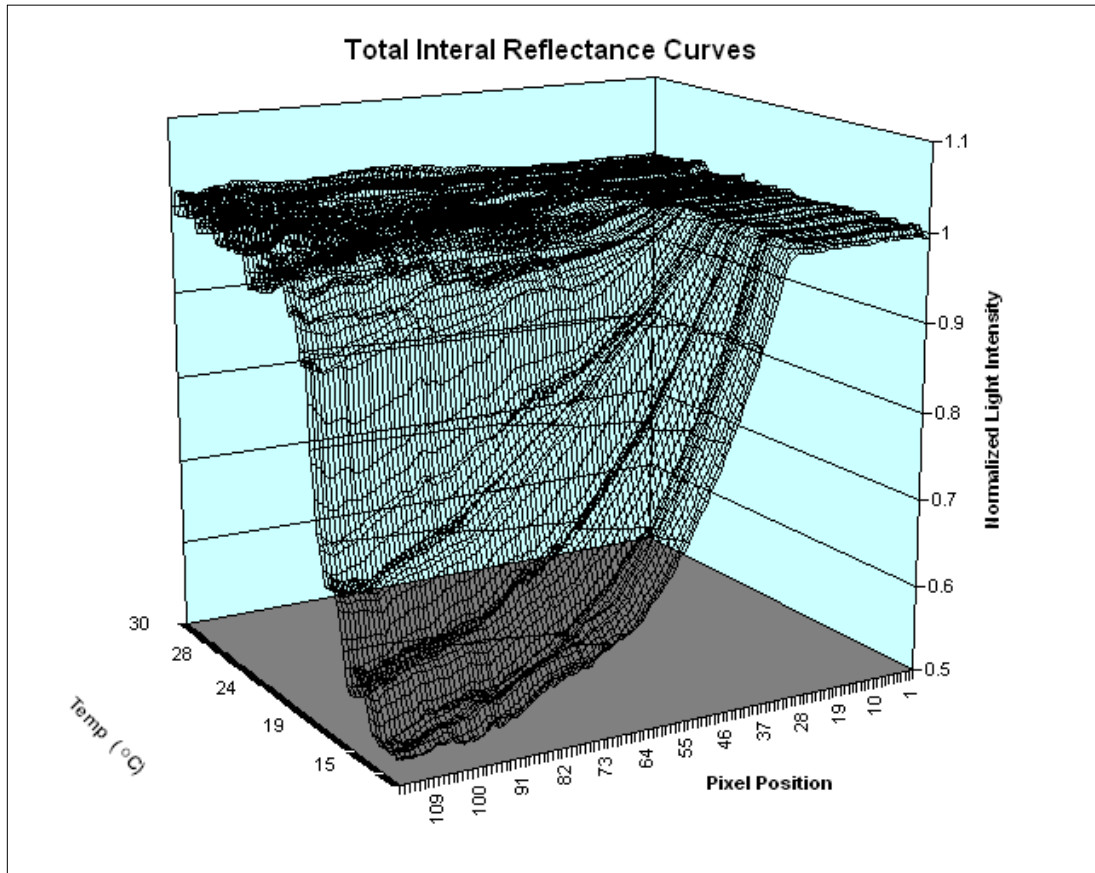


Figure 1. Jetalon GS-88™ VHP Monitor Data: Measuring OoC by Reflected Light

Notes:

- Dewpoint Refractometer ©has monolayer sensitivity
- Thin layer of condensed VHP is detected; referred to as the Onset of Condensation (OoC)
- Transitions of condensed VHP layer from a 2 dimensional film to a 3 dimensional liquid are observed.

VHP Monitoring Techniques Comparison

This table compares the characteristics of two common VHP monitoring techniques, near infrared and electrochemical, with the proprietary GS-88 technology: Dewpoint refractometry©.

Technology	Pros	Cons
Near Infrared	<ul style="list-style-type: none"> • Concentration Accuracy • Response Time • No Measurement Retention 	<ul style="list-style-type: none"> • Price • Vibration Sensitivity • Factory Recalibration • Medium Dynamic Range • Large Footprint • Dynamic Range
Electrochemical	<ul style="list-style-type: none"> • Lower Price • Portable • Small Footprint • Dynamic Range (with two probes) 	<ul style="list-style-type: none"> • No Vacuum Operation • Slow Response Time • Factory Recalibration • Measurement Retention
Dew point Refractometry	<ul style="list-style-type: none"> • High Accuracy, Repeatability, Response Time • Wide Dynamic Range • Simultaneous Measurements of Dew point, μConcentration, and temperature • On Site Calibration Possible • Ultra High Purity Materials • Small Footprint 	<ul style="list-style-type: none"> • Speciation is to be determined • Low concentrations

Table 1. VHP Measuring Technologies: Jetalon GS-88™ measures using Dew Point Refractometry©

GS-88 Performance: Vapor Hydrogen Peroxide Repeatability

Cycling the temperature of the window clears the condensate and allows repeated measurements to be taken rapidly and accurately. Here, measurements are repeated every 30 seconds.

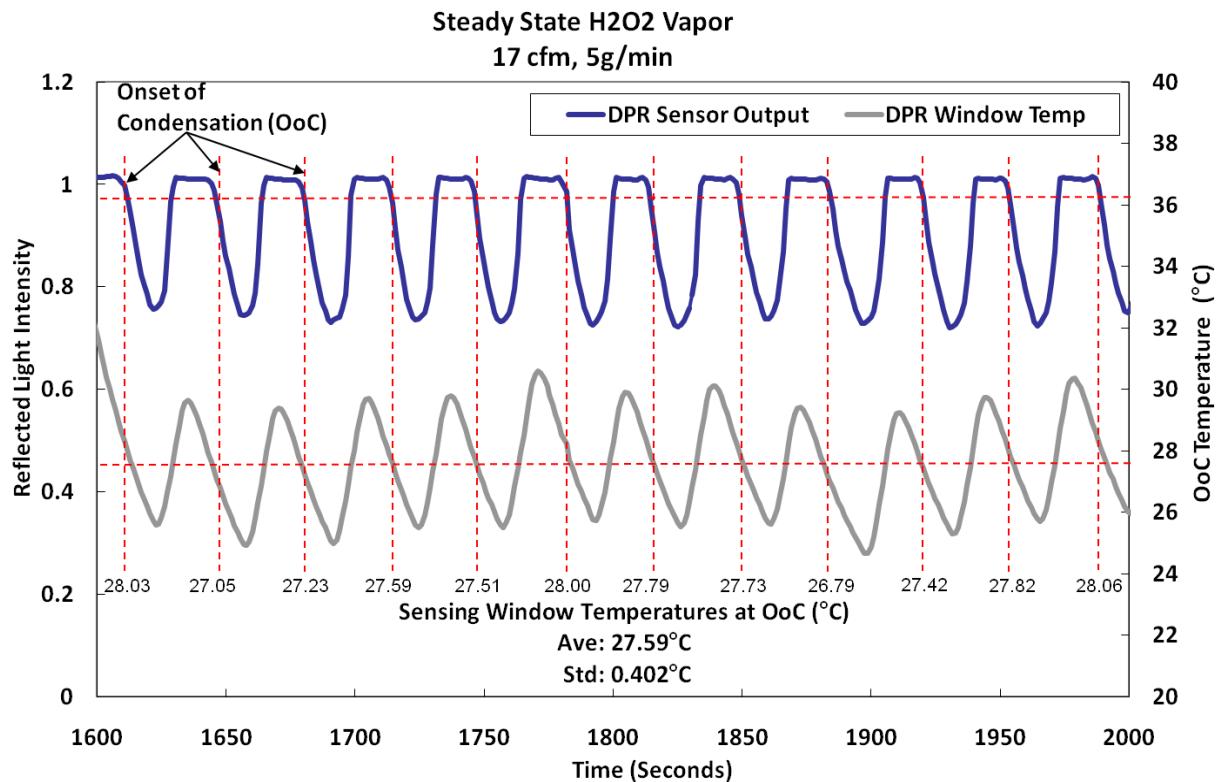


Figure 2. Jetalon GS-88™ Rapid Repeatability of Measurement

GS-88 Dew Point Refractometer© and Guided Wave NIR Comparison

The graph shown in Figure 3 demonstrates that the Dew Point Refractometry© technique used by GS-88 tracks the data as accurately as the widely used NIR method.

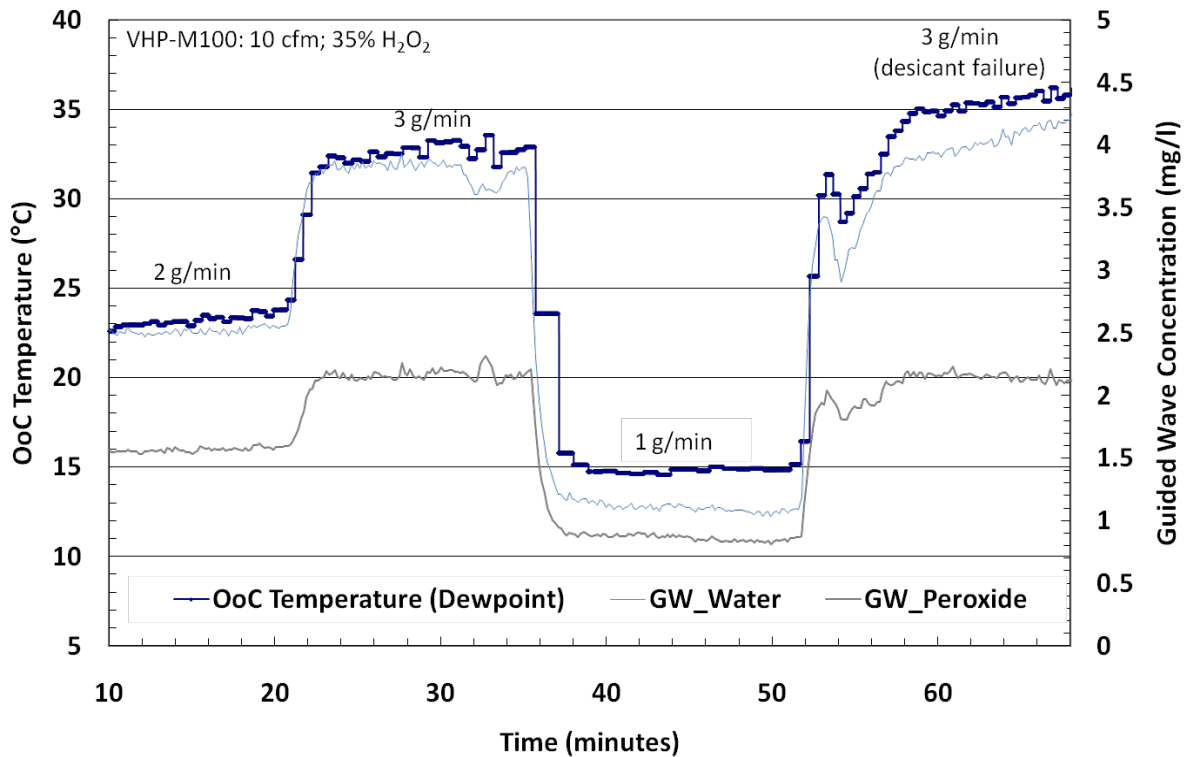


Figure 3. Data collected by Jetalon GS-88 Dew Point Refractometry technique compares favorably with VHP data measured by NIR

ⁱ GS-88 is a registered trademark of Jetalon Solutions, Inc. Dewpoint Refractometer and Dewpoint Refractometry are © Jetalon Solutions, Inc.