

APPLICATION NOTE



High-Viscosity Vacuum Residuum Desulfurization (VRDS)

Executive Summary

Measuring total sulfur in heavy Vacuum Residuum Desulfurization (VRDS) paraffin samples present significant challenges for online analyzers, due to their high viscosity and high temperatures required to vaporize the sample, which accelerates thermal oxidation and fouling of the sample transfer line.

This report details the field optimization of an ATOM SLA analyzer, demonstrating that through optimization of operating parameters, reliable results with good precision can be achieved with an online analyzer typically not suited for this type of analysis



ATOM
SLA Analyzer

The Challenge: Handling Heavy Feedstocks

Total sulfur analysis methods often struggle with VRDS process streams due to the high temperatures required for sample vaporization that causes increased rates of thermal oxidation and sample deposition that gradually plugs the end of the transfer tube as it is introduced into the combustion furnace.

A field test performed at an installation in a major west coast refinery saw transfer tube failures that initially plugged after only a few days of operation.

Technical Optimization Strategy

1. Hardware & Thermal Management

To slow the rate of thermal oxidation and buildup of varnish-like residues, the transfer tube outlet was repositioned to a lower temperature region of the furnace inlet. Although this reduced vaporization rate and broadened the peak, it could conceivably balance analytical precision, required analysis cycle time, and associated maintenance interval for transfer tube replacement.

2. Pneumatic & Integration Tuning

Two separate flows of Zero grade air are used for this analysis with total air flow maintained at 200 cc/min. Carrier flow through the transfer tube was initially increased from 60 cc/min to 100 cc/min., with the balance of combustion air flow adjusted accordingly.

Higher carrier flow increases gas velocity to better "sweep" the inner walls of the transfer tube, thereby reducing subsequent sample buildup and sharpening the resulting peak. After some improvement to both analysis and maintenance interval was achieved, carrier flow was further increased to 150 cc/min. with the balance of combustion air flow reduced to 50 cc/min., which demonstrated the most promising results.

Since the VRDS sample exhibited considerable peak "tailing" after the transfer tube was repositioned, analysis cycle time was subsequently increased to 300 seconds to ensure the sulfur peak was fully integrated

Proven Performance Data

Following these optimizations, the analyzer underwent a period of long-term testing by refinery personnel. Since an equivalent calibration standard was impractical for use as reference to evaluate repeatability, a series of 10 sequential runs over 50 minutes was run on the VRDS process stream, which yielded the following results:

Average Concentration:	713.2 ppm
Standard Deviation:	8.16 ppm
Repeatability (RSD):	1.14%

Conclusion for Process Engineers

The ATOM SLA analyzer can be successfully applied to VRDS refinery applications by optimizing both sample transfer gas velocity and adjusting the point of injection to a lower-temperature region of the combustion tube. This configuration balances the trade-off between performance, cycle time, and maintenance intervals, providing reliable sulfur measurement for this refinery process.

Sales & Value Proposition

Uptime: Strategic tube placement extends the life of the transfer tube consumable from a few days to a more economical and sustainable preventative maintenance interval of greater than 30 days.

Accuracy: Achieves near-laboratory measurement precision (approx. 1% RSD) with an online total sulfur analyzer to measure challenging VRDS refinery streams.

Flexibility: The system is adaptable to other high-sulfur and high-viscosity paraffinic samples whose properties are well outside the standard ASTM 5453 measurement range.

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