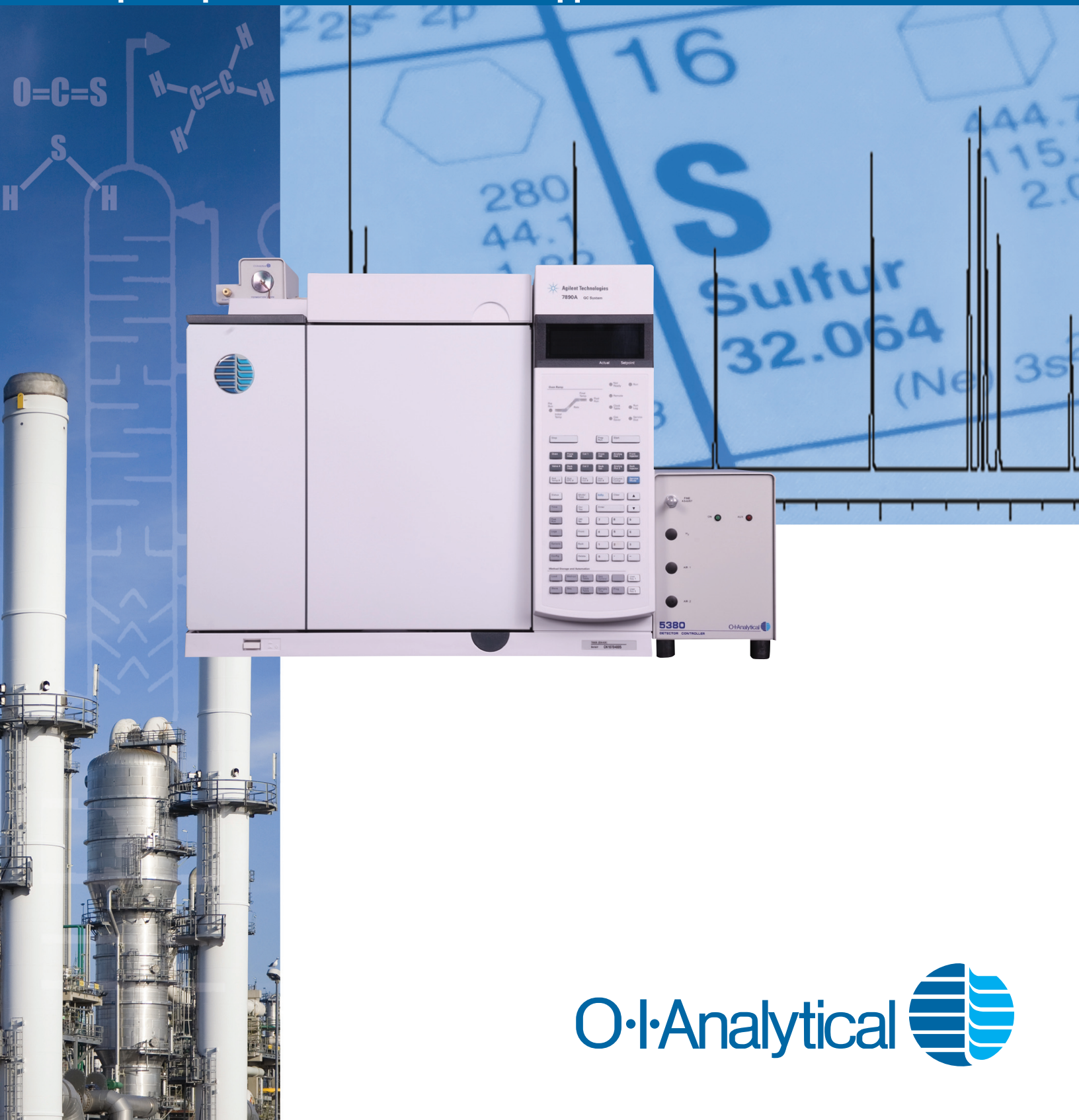
S-PRO 3200

GC System for Sulfur Analysis

Unique Capabilities for Gas-Phase Applications



O·I·Analytical

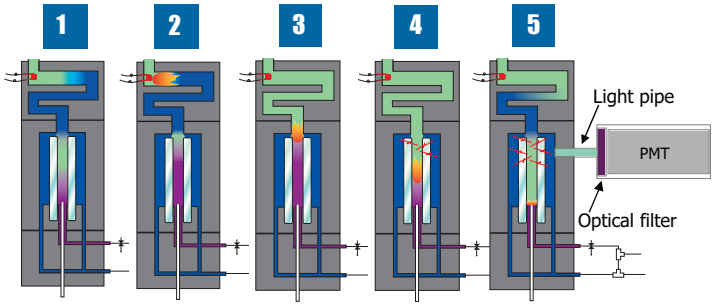
Superior Selectivity

S-PRO 3200 Gas Chromatograph

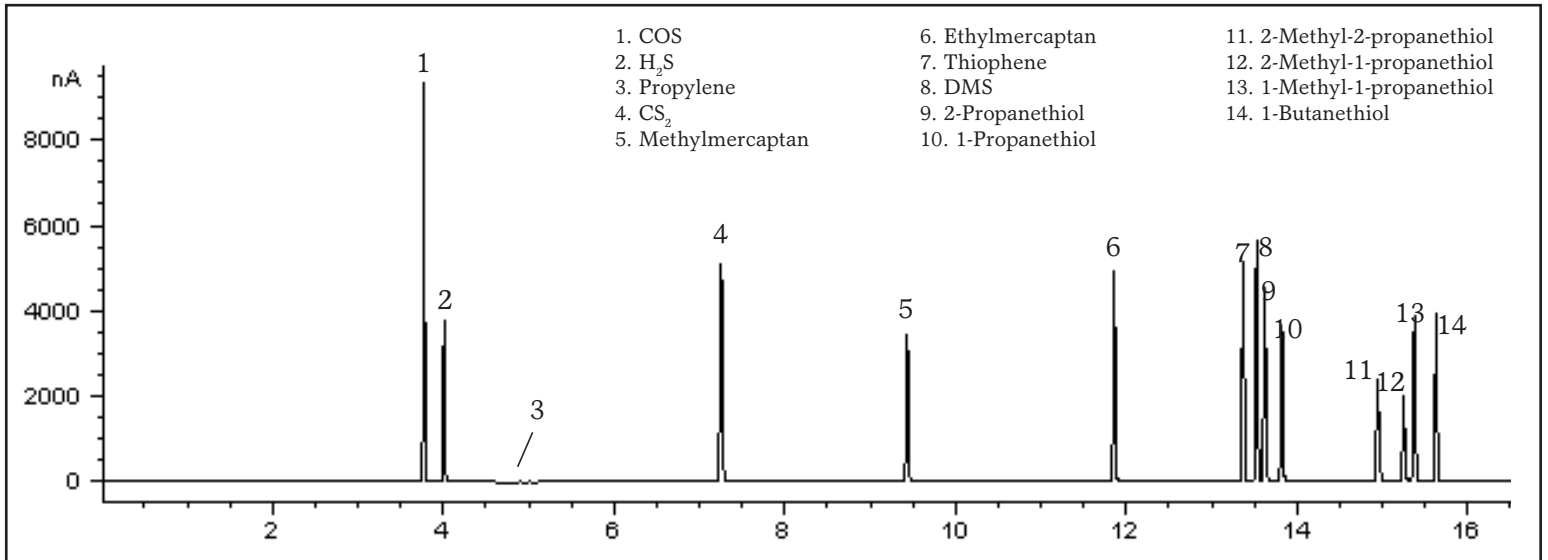
The S-PRO 3200 is a custom-configured gas chromatograph for selective, high sensitivity measurement of sulfur compounds in gas-phase samples and Liquefied Petroleum Gas (LPG) streams such as propylene and ethylene.

The key technology within the S-PRO 3200 system is OI Analytical's patented* Pulsed Flame Photometric Detector (PFPD). The PFPD has a linear, equimolar response to sulfur allowing selective measurement of individual sulfur species from low ppb to ppm levels, and total sulfur as the sum of individual peaks. The unique capability to obtain simultaneous sulfur and hydrocarbon chromatograms from a single PFPD detector sets it apart from other sulfur detection technologies.

PFPD Principle of Operation



A combustible mixture of H_2 and air is introduced and fills the detector body and cap from the bottom up (1). The combustion mixture is ignited in the cap (2). The resulting flame propagates along the pathway consuming the H_2/air mixture (3). Compounds eluting from the GC column are combusted within a quartz combustor and emit light at element-specific wavelengths (4). The flame is extinguished when it reaches the bottom of the detector and excited species continue to fluoresce for up to 25 milliseconds. Emissions from the excited species pass along a light pipe and selected emissions are transmitted through an optical filter to a photomultiplier tube for detection (5). The entire pulsed flame cycle is repeated approximately 3 to 4 times per second.



Thirteen Light Sulfur Compounds in a Propylene Standard on the S-PRO 3200

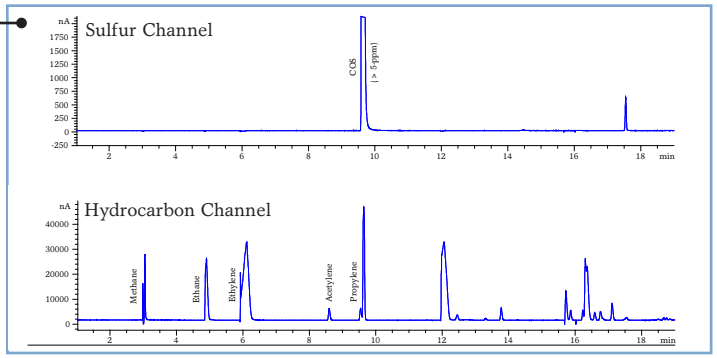
and Sensitivity in Sulfur Analysis

The ability to detect and measure sulfur contaminants in gases is critically important for efficient operation of industrial processes and to control product quality. S-PRO 3200 GC systems have proven highly effective in demanding sulfur analysis applications.

- Sulfur Content in Liquefied Petroleum Gas (LPG)
- COS in Ethylene and Propylene Feedstock
- Sulfur in Natural Gas
- Impurities in Beverage Grade CO_2
- Semiconductor and Industrial Gas Purity
- Quality Control in Gas Production and Blending Operations

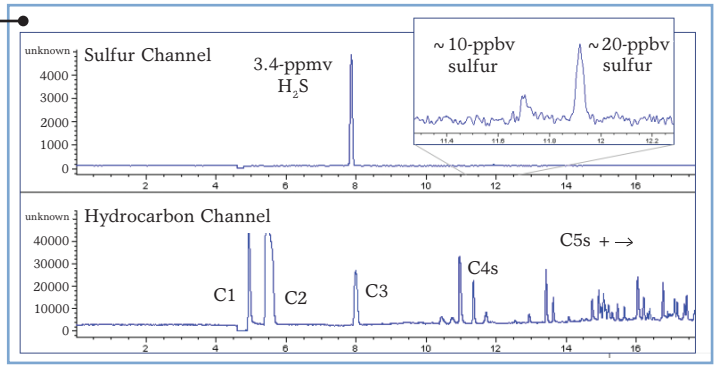
Ethylene and Propylene Feedstock

Propylene is a co-product from steam cracking of ethylene. Carbonyl sulfide (COS) is a major contaminant in propylene feedstock and can destroy expensive catalyst beds used in polymer production and other processes if not removed. The accompanying chromatograms show the hydrocarbons and COS present in a feedstock gas before separation of propylene and ethylene components, and prior to sulfur scrubbing.



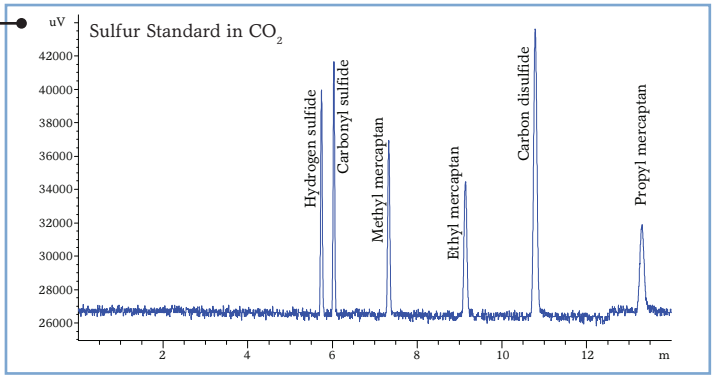
Natural Gas

Natural gas containing hydrogen sulfide or mercaptans is referred to as "sour" gas. The concentration of hydrogen sulfide in natural gas ranges from barely detectable levels to more than 0.30% (3,000 ppm).[1]



Sulfur Impurities in CO_2

Early detection and control of H_2S and COS is an important consideration in the production of food-grade CO_2 because the presence of these compounds can impart undesirable odors and flavors to carbonated beverages.



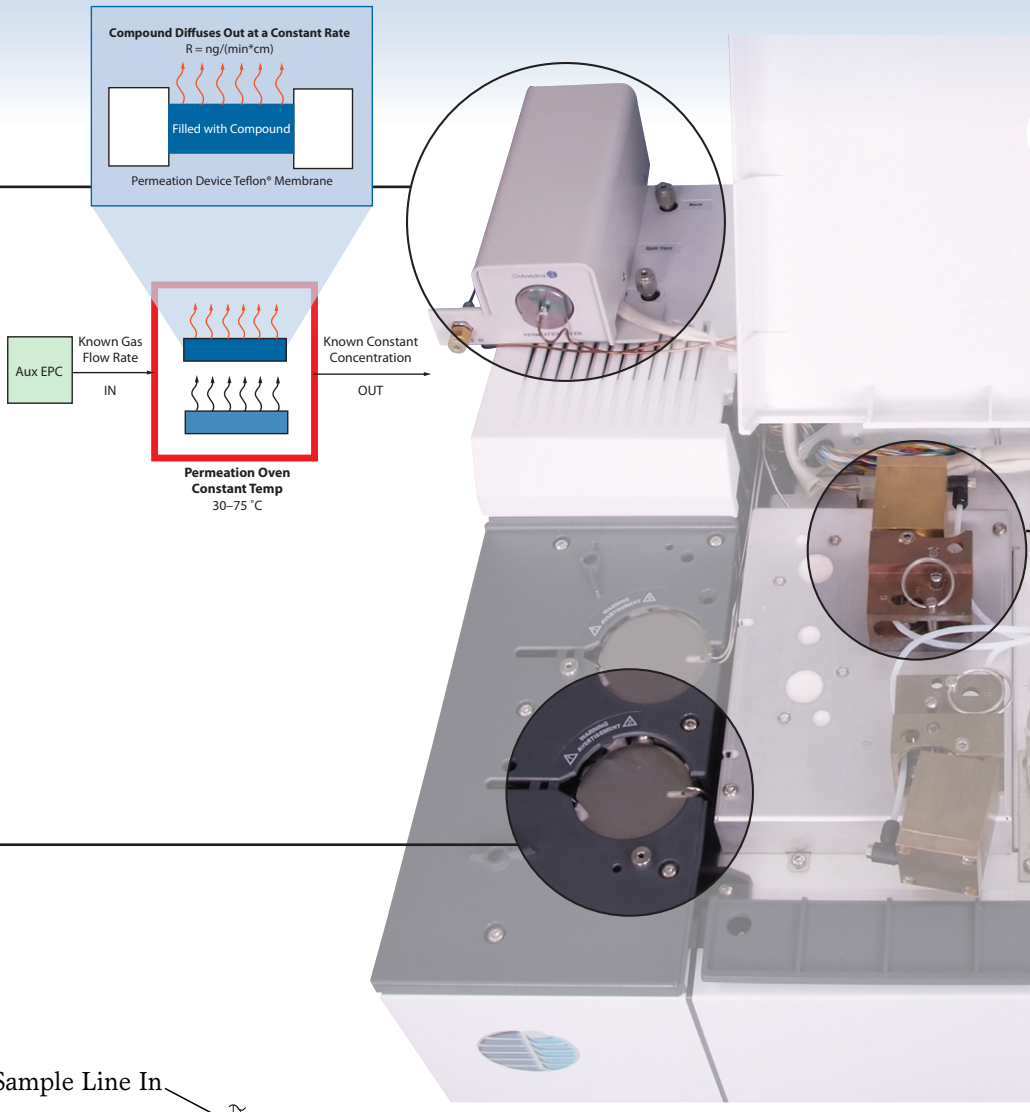
1. – *The Chemistry and Technology of Petroleum, Marcel Dekker, Inc., 1991.*

The Turn-Key Solution for Sulfur Analysis

The S-PRO 3200 is a complete turn-key system for sulfur analysis in gas-phase samples. OI Analytical has integrated a number of special design features into the Agilent 7890 GC platform to provide unique analytical and performance capabilities.

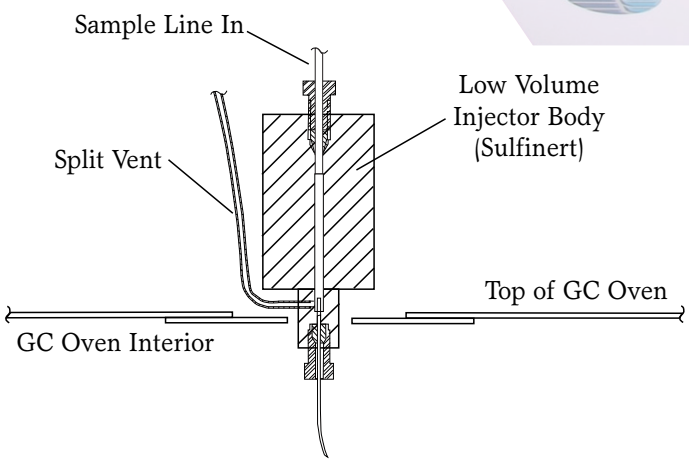
Permeation Oven

A permeation oven is fully integrated into the S-PRO 3200 to generate gas-phase calibration and QA/QC check standards at point of use. The oven accommodates up to five permeation devices. A pure sulfur compound sealed inside the permeation device diffuses across a permeable Teflon® barrier at a temperature-dependent rate. Precise control of the permeation oven temperature produces a constant diffusion rate. A controlled, measured flow of dilution gas is passed through the oven creating an accurate gas standard for calibration. Temperature and dilution gas flow are controlled through the Agilent 7890 keypad or ChemStation.



Volatiles Interface

The OI Volatiles Interface enables users to introduce low-concentration gas samples at varying split ratios from gas sampling valves and achieve a wide dynamic range. The design has been optimized for ultralow dead volume flow rates, inertness, and ease of column installation.



Sulfinert® System Components

Volatile sulfur compounds such as H_2S, methyl and ethyl mercaptan adsorb strongly to the surfaces of untreated metals. The entire sample pathway of the S-PRO 3200 is constructed of Sulfinert® treated stainless steel components to prevent adsorption of sulfur compounds that could cause inaccurate, low sulfur measurements.

S-PRO 3200 Specifications

Detectivity	Sulfur < 1 pg S/second
Selectivity	At optimum detectivity levels: Sulfur > 10^6 S/C
Permeation Oven	Temperature range: 30 - 75 ˚C ± 0.05 ˚C
OI Volatiles Interface	Effective split range: Splitless to 150-to-1, Maximum Temperature: 325 ˚C
GC Column	GS-GasPro, 30-meter x 0.32 mm I.D. Maximum Temperature: 260 ˚C

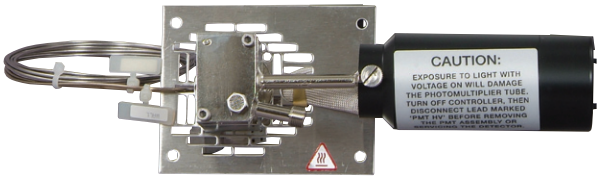
Automated Injection System

A pair of electronically controlled air-actuated valves automates sample introduction, system calibration, and QC checks. A 4-port sample selection valve enables the user to select a sample from a gas stream, or to deliver calibration and check standards from the permeation oven. A 6-port gas-phase switching valve with a sample loop injects samples through the OI Volatiles Interface into the GC column.

Sulfur Detection

The Pulsed Flame Photometric Detector (PFPD) produces simultaneous, mutually selective sulfur and hydrocarbon chromatograms from a single detector. The linear, equimolar response generates a single response factor for sulfur content in both known and unknown sulfur species from low ppb to ppm levels.

The PFPD uses a hydrogen and air mixture at a flow rate that does not support continuous combustion. In operation the combustor fills with an H_2-air gas mixture and is ignited. A flame propagates through the combustor and burns out when the fuel mixture is consumed. The cycle is repeated continuously 3 or 4 times per second. The constant pulsing of the flame makes the PFPD inherently self-cleaning and virtually eliminates soot formation or "coking". The PFPD exhibits long-term stability and requires far less maintenance than other detectors by avoiding the build up of soot deposits that can interfere with transmission of sulfur emission signals.



Pulsed Flame Photometric Detector

Sulfur Analysis in Petrochemicals

Gas and Liquid Phase Petrochemicals

Carbonyl Sulfide in Propylene (ASTM D5303)

Sulfur Compounds in Natural Gas (ASTM D5504 & D6228)

Ultra-low-sulfur Gasoline (ULSG)

Ultra-low-sulfur Diesel (ULSD)

Thiophene in Benzene (ASTM D4735-02 & D7011)

Sulfur Compounds in Light Petroleum Liquids (ASTM D5623)

Jet Fuel

Naphtha

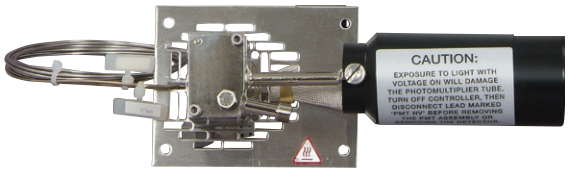
Crude & Synthetic Oils

Furnace Oil

Light Cycle Oil (LCO)

*pportunity through Innovation™

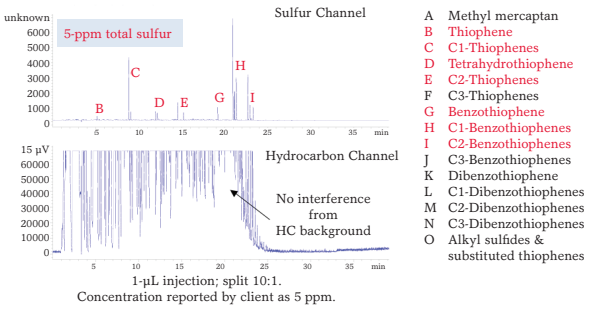
* *U.S. Patent 5,153,673*



PFPD – Pulsed Flame Photometric Detector

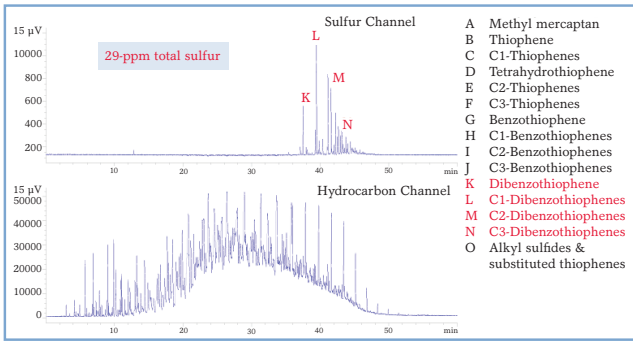
The PFPD is widely used in laboratory and process gas chromatographs to analyze sulfur species and total sulfur levels in liquid-phase petrochemicals.

Gasoline



1-µL injection; split 10:1.
Concentration reported by client as 5 ppm.

Diesel Fuel



ISO 9001 2000 SYSTEM CERTIFICATION SGS

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