Application Note

H_2S in semi-regenerative catalytic reformer hydrogen recycle streams

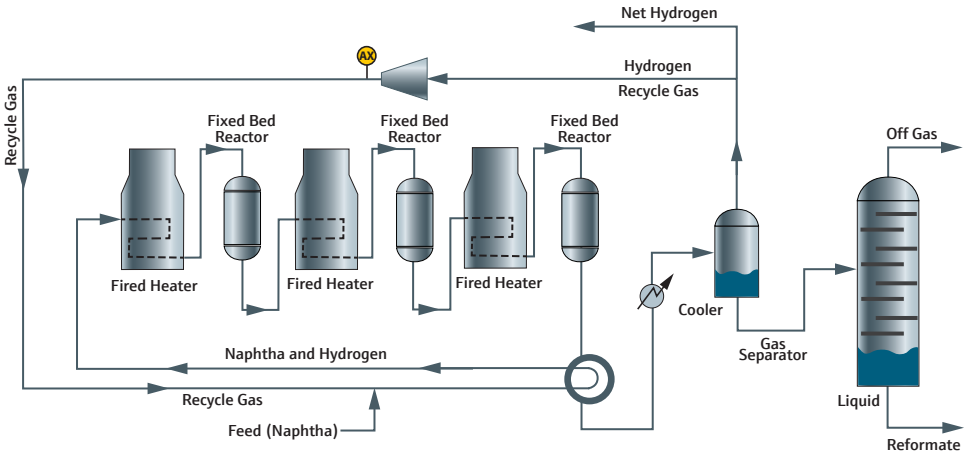
Industry:
Refining
Application Note 23202

Key Points

- Fast response to H_2S concentration changes
- Patented* Differential Spectroscopy technique measures H_2S at low ppm levels in catalytic reformer hydrogen recycle gas
- Laser-based measurement is highly selective and accurate for H_2S in catalytic reformer hydrogen recycle gas
- Low maintenance and OPEX costs – no cylinders of carrier or combustion gases, or lead acetate tape

*www.spectrasensors.com/patents

Catalytic reforming A catalytic reformer unit converts naphtha into high-octane aromatic compounds termed reformates used in gasoline blending and yields large quantities of hydrogen that is recycled and used in other processes. A semi-regenerative catalytic reformer (SRR) unit has three fixed bed catalytic reactors employing a platinum/rhenium (Pt/Re) catalyst on a chloride alumina support. H_2S and other sulfur compounds poison the Pt/Re catalyst increasing coking, and decreasing hydrogen production and reformate yield. For this reason the naphtha feed to an SSR undergoes treatment in a hydrotreater unit to remove H_2S and other sulfur compounds.



Semi-Regenerative Catalytic Reformer

On-line H_2S monitoring On-line monitoring of the H_2S concentration in SRR hydrogen recycle streams enables refineries to control H_2S contamination in SRR reactors at the low levels required for optimum catalyst activity and reformate yield. Catalyst activity in an SRR gradually decreases over time as coke is deposited on the catalyst. The SRR must be shut down periodically to burn off coke deposits which halts production of reformate and hydrogen. Monitoring and controlling the H_2S level in hydrogen recycle gas helps extend the time period between SRR shut downs for catalyst regeneration.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective in this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H_2S concentration, an important performance characteristic for monitoring and controlling H_2S levels in an SRR unit. SpectraSensors' patented* differential spectroscopy technique enables detection and quantitation of low ppm levels of H_2S in SRR hydrogen recycle gas. Laser and detector components are isolated and protected from process gas and entrained contaminants avoiding fouling and corrosion, and ensuring stable long-term operation and accurate measurements.

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Application Data	
Target Component (Analyte)	H_2S in Semi-Regenerative Reformer Hydrogen Recycle Gas
Typical Measurement Ranges	0-50 through 0-300 ppm*
Typical Repeatability	±2% of Full Scale*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H_2S scrubber included)
Validation	Certified blend of H_2S in Nitrogen balance

*Consult factory for alternate ranges.

Typical Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Hydrogen	70	80	90
Methane (C_1)	8	12	20
Ethane (C_2)	3	5	10
Propane (C_3)	0	2	5
i-Butane (C_4H_{10})	0	1	2
n-Butane (C_4H_{10})	0	<1	2
C_5	0	0	1

The background stream composition must be specified for proper calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially H_2S, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

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