SNG: common syngas header after scrubbers

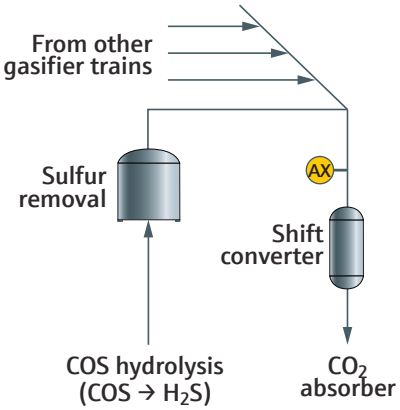

Figure 1: Common gasifier header effluent sampling point for a multi-train IGCC plant*

Benefits at a glance

- Unique spectroscopic capability to measure all syngas components, including H_2 and N_2
- Pipe-centric sampling and measurement at the sample tap
- Complete syngas speciation
- No valves, columns, or carrier gas
- No routine calibration
- No interference from moisture vapor in the raw syngas sample when the sample is kept above its dewpoint

In a multi-train gasifier system, gasifiers are typically required to be taken off-line for maintenance (e.g. refractory maintenance/replacement). Run times can vary from six months to two plus years. In such cases, a multi-train configuration is adopted to allow for any gasifier to be off-line yet maintain adequate throughput of syngas by the remaining gasifiers. A common header is used to combine the syngas streams to route to the downstream processes. When carbon capture and sequestration (CCS) of CO_2 is part of the plant design, the common header will feed a shift converter. If the end product is pipeline quality SNG, methanation of the syngas is followed by H_2 recovery in a purification step prior to sending the SNG to the pipeline. If the syngas is to be used as fuel for combined cycle power generation, the CO_2 depleted syngas stream is routed to a gas turbine.

Measurement of raw syngas composition

The Raman Rxn5 analyzer is a unique solution to the sampling and measurement challenges for analyzing the effluent of the common syngas header. An Raman spectrum for a typical syngas stream from the common syngas header is shown in Figure 2. Note the simplicity and complete speciation of H_2, CO, CO_2 and CH_4 as individual peaks in the Raman spectrum. Low levels of both H_2S and NH_3 can also be measured in the same sample, when present at concentrations > 0.1%. In addition, as the Raman Rxn5 analyzer is essentially transparent to moisture, the analysis represents a dry basis result. The Raman Rxn5 uses a normalized analysis which makes it very robust to changes in process pressure, temperature, and flow, as well as to any slow fouling that may occur.

Reliability issues with traditional methods for syngas analysis

In general, syngas is measured with process gas chromatography (GC) or mass spectrometry (MS). Both technologies require a low pressure sample and sample transportation to the analyzer, adding lag time to the speed of analysis. In the case of the raw syngas stream from the common gasifier header, the use of a dynamic reflux sampler (DRS) or alternative liquid and particulate removal system is mandatory. Protecting the analyzer from liquid carryover is the main challenge as this event can damage columns in a GC or the ionization chamber in an MS. The Rxn-30 probe used by the Raman Rxn5 analyzer cannot be damaged by liquid carryover or fouling, and it can be easily cleaned.

* See the general IGCC plant SNG: production analytics overview

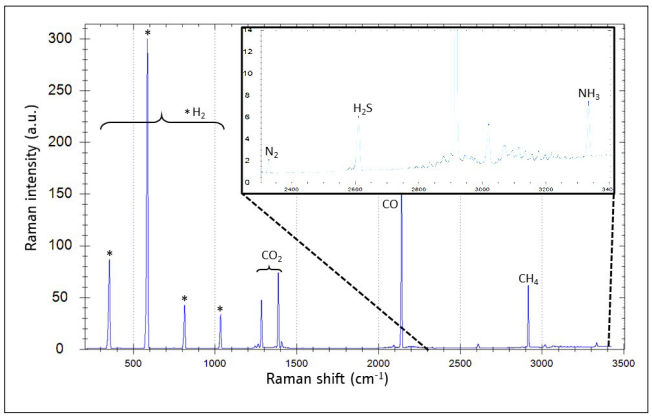

Figure 2: Typical Raman spectrum for shift converter outlet

Solution: Raman Rxn5 analyzer with the common syngas header after scrubbers method

The use of a liquid removal system is mandatory for the common header outlet stream, which is saturated with steam at high temperature (typically 250-380 °C). The Rxn-30 probe can be easily integrated into sample conditioning systems to measure process streams at higher temperatures and pressures. The ability to measure at higher pressures often allows the sample to be returned to the process, eliminating waste and costly flaring. The use of fiber optic cables allows the probe to be placed at the sample tap location, eliminating the need for long heated sample transfer lines and sample lag time.

The Raman Rxn5 syngas after scrubber contains the following per measurement point:

- Dedicated laser module
- Rxn-30 fiber optic probe
- Industrial hybrid electro-optical cable (up to 150 m long, customized to your plant requirements)
- Combined pressure and temperature sensor with cable (up to 150 m long, customized to your plant requirements)
- Dedicated syngas after scrubber method

Typical process conditions	P (barg)	T (°C)
At sample tap	49	199
At Rxn-30 probe	49	55

Typical stream composition

Component	Range (Mol%)	Normal (Mol%)	Precision (Mol%) k=2	Cal gas (Mol%)	Precision (Mol%) k=2
Hydrogen	25-45	34.3	0.02	35	0.02
Nitrogen	0-2	0.4	0.01	1	0.01
Carbon monoxide	30-50	40	0.02	38	0.02
Carbon dioxide	10-30	21.7	0.03	21	0.03
Methane	0-10	2.3	0.01	5	0.01
Hydrogen sulfide	0-2	0.4	0.01	0	N/M
Ammonia	0-2	0.9	0.01	0	N/M

Table 1: Typical process conditions and stream composition

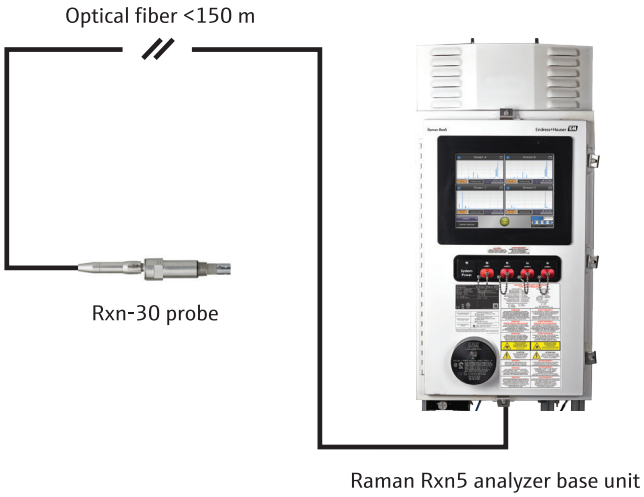

Figure 3: Recommended system configuration

AI01337C/66/EN/01.21

Endress+Hauser
People for Process Automation