

Use of Process Analytics for Cracking Processes in Refineries

Crude oil processing

Crude oil is a complex mixture of hydrocarbon compounds and relatively small quantities of other materials such as oxygen, nitrogen, sulphur, salt and water as well as inorganics and metals. It occurs naturally in the ground and was formed millions of years ago.

Crude oil varies from source to source in composition and colour. It is typically mixed with gases, which have to be separated from the crude oil before it can be further processed. Crude oil itself is of little use. To get the maximum value from crude, it needs to be refined and blended in a refinery into more valuable and useful petroleum products: fuels, lubricants, waxes, asphalt, plastics, fibres, detergents, fertilizers and many others.

An oil refinery is a well structured arrangement of manufacturing processes designed to perform physical and chemical changes in crude oil to convert it stepwise into intermediate and end products. Refinery processes have been and are continuously developed and optimized in response to changing market demands for certain products. Almost all refineries, regardless of their special product scope, use the same few basic processes like separation (distillation), conversion and treating. *Cracking* belongs to the most common conversion methods.

Process analyzers, mainly process gas chromatographs but also continuous gas analyzers, are standard in a refinery's process instrumentation. They deliver key data to process and product quality control and asset management.

Siemens Sensors and Communication provides efficient analyzers, expertise and solutions to these tasks.

oil & gas INDUSTRY

In the hydrocarbon processing industry (HPI), cracking is the process whereby complex organic molecules (e.g. heavy hydrocarbons) are broken down into simpler molecules by the breaking of carbon-carbon bonds in the base material. The rate of cracking and the nature of end products strongly depend on the temperature and presence of any catalysts. Process automation equipment including gas analysis instrumentation contributes essentially to control and optimize cracking processes.

Siemens Sensors and Communication, a leader in process analytics, has proven worldwide its competence to plan, engineer, manufacture, implement and service analyzer systems for use in cracking plants.

This case study provides detailed information about that.

SIEMENS

Crude oil refining at a glance

Refining process

The key objective of the refining process is to effect chemical reactions on the raw hydrocarbons.

The refining process from crude oil to end-use products comprises several sub-processes (fig. 1).

Fractionation

Because crude oil is a mixture of hydrocarbons with different boiling temperatures, it can be separated by distillation (fractionation) into groups of hydrocarbons (called cuts or fractions) that boil between two specified boiling points (fig. 2).

Two types of distillation are performed: atmospheric and vacuum. Atmospheric distillation takes place in a distilling column at or near atmospheric pressure and at temperatures of 90 to 650 °C. To recover heavy distillates (residues) drawn off from the bottom of this column, the residue is fed to a second distillation column where the process is repeated under vacuum, called vacuum distillation. This allows heavy hydrocarbons with boiling points up to 800 °C to be separated.

Conversion

Conversion processes change the size and/or structure of hydrocarbon molecules by cracking and rearranging molecules to add value. The fractions from the distillation towers are transformed

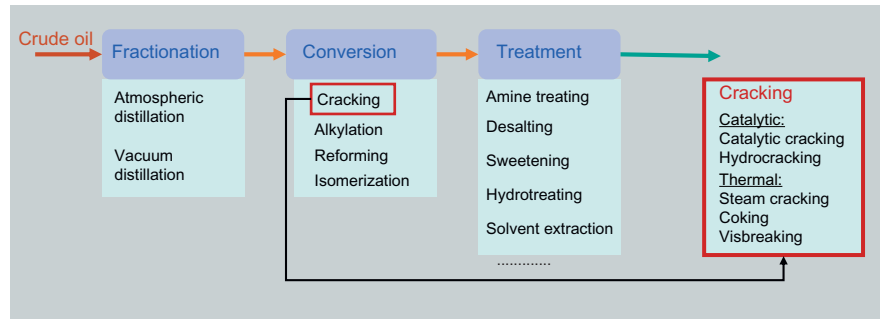


Fig. 1: From crude oil to end-use products

into streams (intermediate components). These processes include:

- Decomposition (dividing) by catalytic and thermal cracking,
- Unification (combining) through alkylation and polymerization and
- Alteration (rearranging) with isomerization and catalytic reforming.

The most widely used conversion method is called „cracking“ because it uses heat and pressure to "crack" heavy hydrocarbon molecules into lighter ones to upgrade products and to yield more desirable hydrocarbon compounds.

A cracking unit consists of one or more reactors and a network of furnaces, heat exchangers and other vessels.

Treatment

Treatment processes (fig. 3) are intended to prepare hydrocarbon streams for additional processing and to prepare finished products.

Treatment includes the removal or separation of aromatics and naphthenes as well as impurities and may involve chemical or physical separation e. g. dissolving, absorption or precipitation such as desalting, drying, desulfurizing, sweetening, solvent extraction, etc. Hydrotreating is used to remove sulfur and reduce nitrogen and some of the metals contained in the stream by means of hydrogen gas and a catalyst.

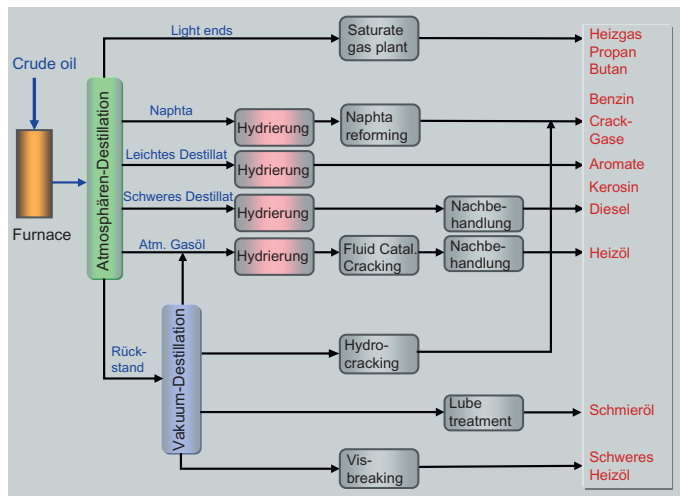
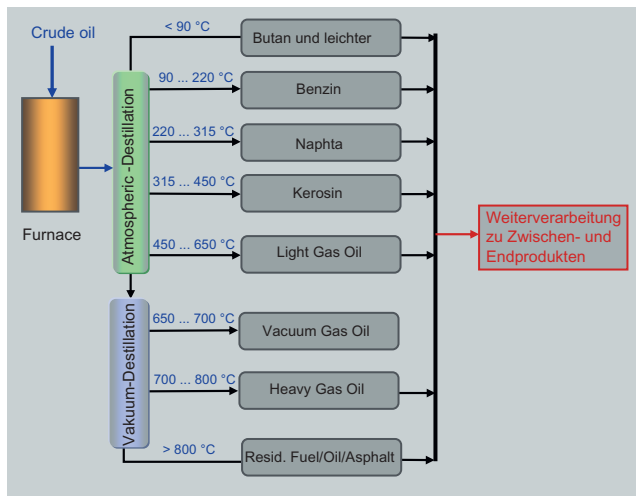


Fig. 2 and 3: Crude oil refining, separation by boiling points (left), typical processing steps (right)

Cracking processes

Cracking is, as already explained, a process used to convert heavy hydrocarbon fractions obtained by vacuum distillation into a mixture of lighter and more useful products (fig. 4).

Catalytic Cracking

In catalytic cracking, the feedstock undergoes a chemical breakdown, under controlled heat (450 to 500 °C) and pressure, and in the presence of a catalyst, a substance which promotes the reaction without itself being chemically changed. The cracking reaction yields petrol, LPG, unsaturated olefin compounds, cracked gas oils, cycle oil, light gases and a solid coke residue. Cycle oil is recycled to cause further breakdown and the coke, which forms a layer on the catalyst, is removed by burning.

Fluid Catalytic Cracking (FCC)

Fluid catalytic cracking (fig. 6) uses a catalyst in the special form of a very fine powder which flows like a liquid when agitated by steam, air or vapour. Feedstock entering the process immediately meets a stream of very hot catalyst in the riser and vaporises. The resulting vapours keep the catalyst fluidised as it passes into the reactor, where the cracking takes place and where it is fluidised by the hydrocarbon vapour. The catalyst next passes to a steam stripping section where most of the volatile hydrocarbons are removed. The spent catalyst then passes to a regenerator vessel where it is fluidised by a mixture of air and the products of combustion which are produced as the coke on the catalyst is burnt off. The regenerated catalyst then flows back to the reactor. The catalyst thus undergoes a continu-

ous circulation between the reactor, stripper and regenerator sections.

The catalyst is usually a mixture of aluminium oxide and silica. The introduction of synthetic zeolite catalysts has allowed much shorter reaction times and improved yields.

Hydrocracking

Hydrocracking (fig. 8) is catalytic cracking in the presence of hydrogen. The extra hydrogen saturates, or hydrogenates, the chemical bonds of the cracked hydrocarbons and creates isomers with the desired characteristics. Hydrocracking uses slightly lower temperatures and much greater pressure to obtain chemical reactions. Hydrocracking produces no residues, only light oils. Wax feed is mixed with hydrogen, heated, and sent to a reactor vessel with a fixed bed catalyst, where cracking and hydrogenation take place. Products are then sent to a fractionator to be separated. The hydrogen is recycled.

Thermal Cracking

Thermal cracking uses heat to break down the residue from vacuum distillation through upgrading and visbreaking or to produce light fractions or distillates, burner fuel and/or petroleum coke.

Steam Cracking

Steam cracking is a high-temperature process at 750 to 900 °C or more, which produces valuable ethylene and other feedstocks for the petrochemical industry. In steam cracking, a gaseous or liquid hydrocarbon feed like Naphta, LPG or Ethane is diluted with steam and then very briefly heated in a furnace to around 850 °C. In modern cracking furnaces, the residence time is reduced to



Fig. 5: Cracking plant

milliseconds in order to improve the yield of desired products.

After the cracking temperature has been reached, the gas is quickly quenched to stop the reaction in a transfer line exchanger. The products produced in the reaction depend on the composition of the feed, the hydrocarbon to steam ratio and on the cracking temperature & furnace residence time. The process also results in the slow deposition of coke, a form of carbon, on the reactor walls. This degrades the effectiveness of the reactor, so reaction conditions are designed to minimize this. Nonetheless, a steam cracking furnace can usually only run for a few months at a time between de-cokings.

Delayed Coking

Some refineries use the most common „delayed coking“ process, which operates at lower temperatures (ca. 500 °C) and moderate pressure to turn residues into lighter products and a hard, coallike substance (petroleum coke) that is used as an industrial fuel and in the production of electrodes for the steel and aluminum industries.

Visbreaking

is a non-catalytic thermal process that converts atmospheric or vacuum residues via thermal cracking to gas, naphtha, distillates, and visbroken residue. Atmospheric and vacuum residues are typically charged to a visbreaker to reduce fuel oil viscosity and increase distillate yield in the refinery. The process will typically achieve a conversion to gas, gasoline, and distillates of 10 % to 50 %, depending on the severity and feedstock characteristics.

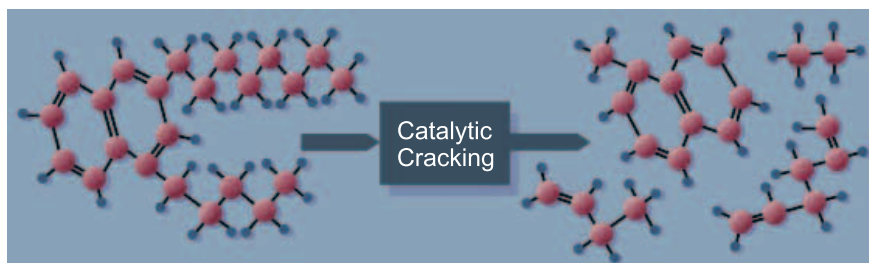


Fig. 4: Cracking principle: one large is cracked into four smaller molecules

Process Analytics in Cracking Plants (1)

Measuring tasks and solutions in FCC plants

Allgemeine Ziele

In Anlagen zum Cracken von Rohöl stellen Gaschromatographen und kontinuierliche Gasanalysatoren wichtige Daten für den Prozess zur Verfügung. Die wesentlichen Ziele dabei sind, durch kontinuierliche Überwachung der Prozessströme auf ihre Zusammensetzung den Anlagenbetrieb hinsichtlich Wirkungsgrad und Produktqualität zu steuern und zu optimieren, Sicherheit für Personen und Anlage zu gewährleisten sowie abzusichern, dass die nach entsprechender Behandlung an die Atmosphäre abgeführten Restemissionen innerhalb der zulässigen Grenzwerte liegen.

Measuring tasks in Fluid Catalytic Cracker

A simplified flow chart of a fluid catalytic cracker (FCC) including typical gas sampling locations along the process path is shown in fig. 6 with corresponding analysis details in fig. 7.

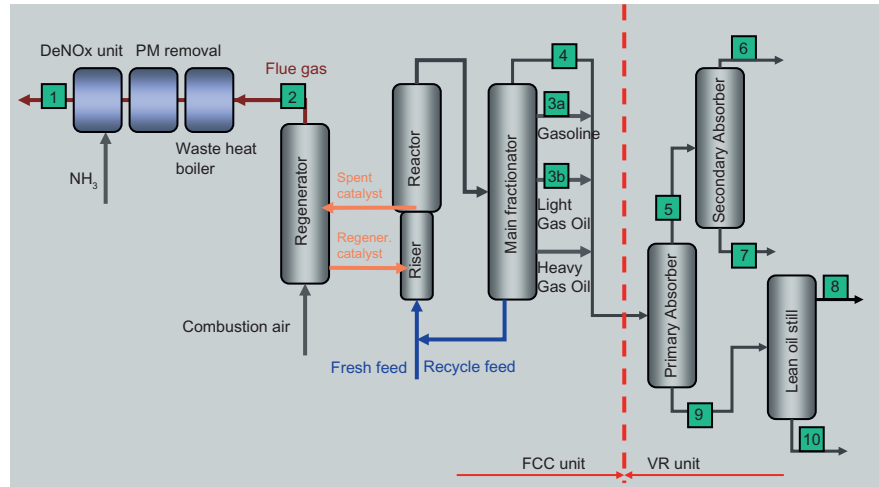


Fig. 6: FCC unit (left) and FCC vapor recovery unit (right), with typical sampling points

The feed (fresh and recycled) is cracked in the reactor using a fluidized catalyst which is continuously regenerated in the regenerator. The flue gas leaving the regenerator passes a waste heat boiler, a particulate matter (PM) and NOx removal plant and is released to the atmosphere. Liquid products are drawn off from the fractionator, the gaseous overhead is fed to the vapor

recovery unit for further separation into useful products.

| Sampling point | Sampling stream | Measuring task | Measuring components | Suitable Siemens Analyzer |
|----------------|--|--|---|---|
| 1 | Flue gas downstream of regenerator | Carbon balance (Efficiency of catalysts regeneration) | Nitrogen ¹ Oxygen ¹⁺² CO ¹⁺³ CO ₂ ¹⁺³ | MAXUM/MicroSAM ¹ OXYMAT 6 ² ULTRAMAT 6 ³ |
| 2 | Flue gas downstream of denitrification | Emission control (NH ₃ from denitrification) | NH ₃ | LDS 6 |
| 3a/b | Gasoline/Light gas oil to blending | Boiling point analysis for gasoline purity (Simulated distillation) | All | MAXUM |
| 4 | Gas to vapor recovery unit | FCC unit mass balance and feed forward control for VRU control | Hydrogen C ₁ to C ₅ | MAXUM |
| 5 | Demethanizer overhead | Minimize olefine loss | C ₃ =, C ₄ = | MAXUM/MicroSAM |
| 6 | Fuel gas | Minimize olefine loss | C ₂ =, C ₃ = | MAXUM/MicroSAM |
| 7 | Rich sponge oil | Reduce recycling of light hydrocarbons | iC ₄ | MAXUM/MicroSAM |
| 8 | Still gas overhead | Reduce impurities in feed to alkylation unit | C ₂ , iC ₄ | MAXUM/MicroSAM |
| 9 | Rich oil | Minimize light hydrocarbons from getting to the feed to alkylation unit | C ₂ , C ₃ , C ₄ | MAXUM/MicroSAM |
| 10 | Debutanized gasoline | Monitor butane content (Reid Vapor Pressure, RVP) | iC ₄ , RVP | MAXUM |

Fig. 7: Sampling points, measuring tasks and analyzers, correlated to fig. 6

Process Analytics in Cracking Plants (2): Measuring tasks and solutions in Hydrocracking plants

Measuring tasks in hydrocrackers

Hydrocracking provides great flexibility regarding acceptance of feed of almost any boiling range and to make products of any desired type.

Fig. 8 shows a simplified flow sheet for a two stage plant. Feed and hydrogen are charged to the first reactor where certain compounds are hydrogenated and cracking is started. Liquids from the separator are charged to the fractionator where some fractions are cut out. Fractionator bottoms are again mixed with hydrogen and fed to the second reactor for further treatment.

Analysis details are shown in fig. 9. Plants with more stages and parallel trains are also common to increase throughput and quality

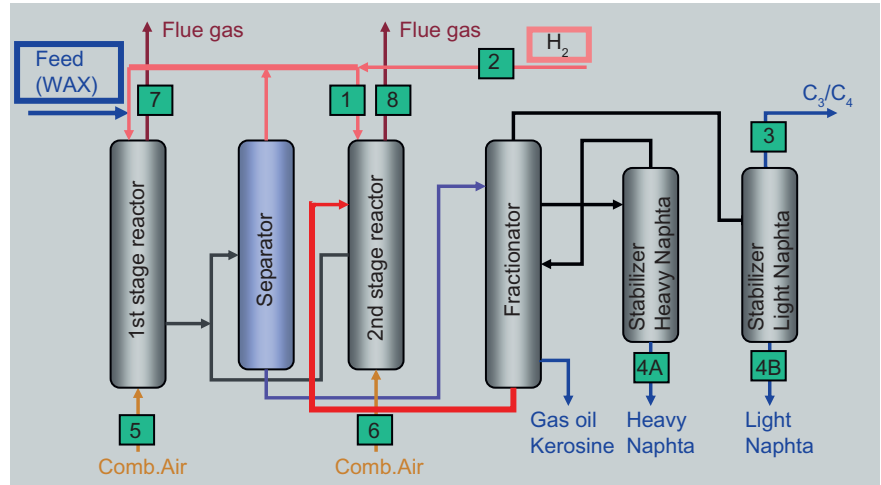


Fig. 8: Hydrocracker flow diagram with typical sampling points

Measuring task in a visbreaker (no figure)

Typical visbreaker measuring tasks are:

- combustion air control and emission monitoring at the heater and the fractionator (similar to line 6 and 7 in fig. 9),
- Oxygen feed and flue gas monitoring at the fractionator and
- fractionator overhead analysis (C2 to C5) using gas chromatography

Measuring tasks in a coker (no figure)

Measuring tasks in a coker are quite similar to those of sampling point 3 and 4 of the hydrocracker as shown in fig. 9.

Measuring tasks in a steam cracker

Measuring tasks in a steam cracker are described in a separate Case Study („Process Analytics in Ethylene Production Plants“).



Fig. 10: MAXUM Prozess-GC in a shelter

| Sampling point | Sampling stream | Measuring task | Measuring components | Measuring Ranges [%] | Suitable Siemens Analyzer |
|----------------|----------------------|--|--|---|---------------------------|
| 1 | Recycle hydrogen | Monitor hydrogen ratio to feed (fix limit value for H ₂) | Hydrogen C1 C2, C3 C4, C5 | 0 ... 100 0 ... 25 0 ... 2 0 ... 0,5 | MAXUM/MicroSAM |
| 2 | Make-up hydrogen | Monitor hydrogen ratio to feed; add H ₂ if recyc. H ₂ is not sufficient | Hydrogen | 0 ... 100 | MAXUM/MicroSAM |
| 3 | Stabilizer overhead | Achieve efficient operation of stabilizer when monitoring carryover of C5 and heavier (fix limit value for C5's) | i-C5, n-C5 i-C4 n-C4 C3 C2 | 0 ... 1 0 ... 40 0 ... 30 0 ... 40 0 ... 10 | MAXUM/MicroSAM |
| 4A/B | Stabilizer bottom | Achieve efficient operation of stabilizers when monitoring C5+ bottom product | i-C4 n-C4 | 0 ... 1 0 ... 1 | MAXUM |
| 5 | Inlet combustion air | Combustion control to meet regulatory requirements for emissions | O ₂ CO | 0 ... 21 0 ... 10 | ULTRAMAT 23 |
| 6 | Inlet combustion air | Combustion control to meet regulatory requirements for emissions | O ₂ CO | 0 ... 21 0 ... 10 | ULTRAMAT 23 |
| 7 | Reactor flue gas | Emission monitoring acc. regulatory requirements | O ₂ , CO, NOx | Regulated | ULTRAMAT 23 |
| 8 | Reactor flue gas | Emission monitoring acc. regulatory requirements | O ₂ , CO, NOx | Regulated | ULTRAMAT 23 |

Fig. 9: Sampling points, measuring tasks and analyzers, correlated to fig. 8

Process Analytics in Cracking Plants (3): Application of MAXUM and ULTRAMAT

Variety and quality of products from cracking processes depend strongly on parameters such as feed composition, cracking temperature, separation performance, process stream composition etc. Thus, it is essential for process profitability and product quality to operate the cracking plants as close as possible to the particular optimal process parameters. Gas chromatography can support this objective essentially.

MAXUM controls process conditions

Process gas chromatography is used to collect the necessary information about the composition of the process streams in order to operate the process at optimal conditions, to get high and constant product quality, to avoid over-cracking, to achieve maximum throughput and to decrease production costs.

Outstanding features

The Siemens MAXUM (fig. 18) is very likely the most suitable gas chromatograph to solve this task. It represents the top technology in process gas chromatography with outstanding features resulting in a high versatility to solve demanding application tasks with best possible analytical results at lowest costs. Selected features are:

- Multiple analytical tools such as ovens, detectors, valves etc.
- Parallel chromatography for fast analysis, system simplification and increase of reliability
- Single and independent dual oven concept (fig. 11) for minimizing the number of analyzers
- Airbath and airless oven to reduce utility costs
- Valveless column switching to reduce maintenance
- Complete networking capabilities and powerful processing software

Parallel Chromatography

MAXUM provides a completely new approach to gas chromatography, named *Parallel Chromatography*.

With Maxum's hardware and software tools, a complex single train analysis can be broken into multiple, very simple single trains. Each of the single trains, called *Applets*, run in parallel, which reduces cycle time compared to a serial run in conventional chromatographs. This is in particular important for measurements where a short response time is required to maintain optimal process conditions. Applets may be standardized for common applications and can be configured alone or in parallel groups, depending on the actual application task.



Fig. 11: MAXUM Dual oven concept
Left: split air bath, temperature programmed
Right: dual airless

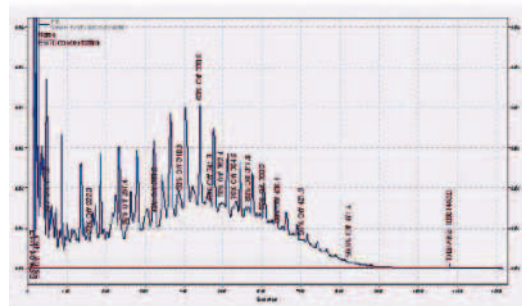


Fig. 12: MAXUM: Simulated distillation

Simulated Distillation

To ensure product quality and to support process control, Simulated Distillation is utilized to characterize the boiling point distribution of hydrocarbon mixtures up to a boiling point of 545 °C in compliance with ASTM methods.

The Siemens MAXUM temperature programmable process gas chromatograph is designed to perform the Simulated Distillation measurement in plants under process conditions and in electrical hazardous areas. Also, its powerful software system produces the calculated outputs required from a simulated distillation analyzer (fig. 12).

ULTRAMAT controls decoking reaction

Continuous gas analysis (NDIR principle) is used to monitor the decoking process in order to reduce steam cracker decoking times and to save maintenance costs e.g. through less coil replacements.

The Siemens ULTRAMAT 6 or ULTRAMAT 23 NDIR gas analyzers are very much suited for this application.

Benefits

On line monitoring of steam cracker and decoking reaction allows to:

- optimize efficiency by varying reaction times
- avoid and reduce simultaneous shut downs of more than one steam cracker for decoking
- decrease of direct decoking cost
- reduction of coil replacements

All together, on-line monitoring through process analytics provides the potential to save many millions of dollars per year in a typical ethylene plant using steam crackers.

Process Analytics in Cracking Plants (4)

Application of LDS 6 for NH₃ slip monitoring

Application

Cracking process

The purpose of a fluid catalytic cracking unit (FCCU) is to crack heavy molecules into lighter and more valuable compounds. This is an endothermic process and takes place in a vertical tube reactor with ascending flow (riser).

The feed is preheated and enters the unit at the base and is mixed with hot regenerated catalyst. The feed is vaporized and the mix of catalyst and hydrocarbon vapor travels up the riser into the reactor. After the cracking into lighter products, the spent catalyst is stripped from the hydrocarbons and fed to the regenerator. The hydrocarbons leave the reactor for separation in a separation column.

Regeneration process

The reaction produces carbon (coke) which remains on the catalyst particle and rapidly lowers its activity. In order to recover its activity, it is regenerated by burning off the coke with air.

The flue gas leaving the regenerator contains a large quantity of CO (carbon monoxide) which is burnt to carbon dioxide in a CO furnace called „Waste heat boiler“ to recover the available heat.

NO_x reduction and NH₃ slip

The combustion exhaust leaving the waste heat boiler contains a large amount of NO_x which, due to environmental permits, must be reduced to very low levels anywhere from 50 to 1 ppm, before it is released to the atmosphere. This is achieved by directing the exhaust through either a selective catalytic (SCR) or a selective non-catalytic (SNCR) reduction unit where NH₃ is injected into the process to react with NO_x and form nitrogen and water. However, under real conditions the reaction runs not always perfectly balanced and some NH₃ can slip through to the atmosphere, called “NH₃ slip”.

Measuring task

Measuring task is to determine continuously the concentration level of NH₃ in the exhaust gas downstream of the denitrication unit.

Solution

The Siemens LDS 6 tunable diode laser in-situ gas analyzer (fig. 16) is very much suited to accomplish this task. It routinely measures NH₃ in a range as low as 0 to 10 ppm. A single LDS 6 analyzer is able to monitor gas concentrations in up to three measurement points simultaneously. In the actual application, either inhomogeneities in the catalyst efficiency throughout the cross section can be monitored by using several measurement channels. Alternatively, more than one DeNOx column can be monitored with only one central unit. The LDS 6 is installed in-situ directly downstream the catalyst, see fig.13.

User benefits

Optimizing the SCR/SNCR process by controlling the NH₃-slip means:

- reducing the consumption of ammonia or urea
 - keeping the legislative threshold values for NH₃ if required
 - stabilizing the process and avoiding peak emissions
 - minimizing technological drawbacks, increasing DeNOx efficiency
 - reducing the total nitrogen - NH₃ and NO_x - emission.
- An optimized process input is the base of minimized emission.

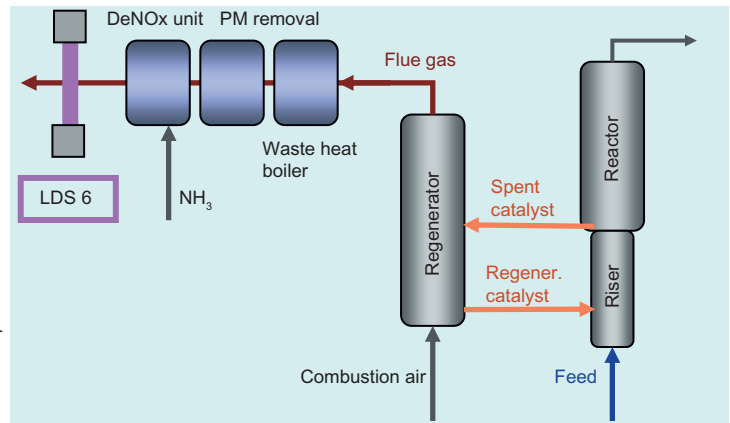


Fig. 13: NH₃ slip measurement in FCC flue gas

The SCR process

Nitrogen oxides (NO_x) formed in combustion processes are efficiently reduced to water and nitrogen in the selective catalytic reduction (SCR) process. Ammonia (NH₃) or urea CO(NH₂)₂ is introduced to the flue gases upstream of a heterogeneous catalyst where the reduction takes place. The SCR process is normally operated in the temperature range of 300 to 400 °C.

The SNCR process

For the selective non catalytic reaction (SNCR) process, ammonia (NH₃) or urea CO(NH₂)₂ is introduced to the flue gases in the hot combustion zone where the reduction of NO_x takes place spontaneously. Depending on the type of the reducing agent, the SNCR process is typically operated in the temperature range of 800 °C to 950 °C. At temperatures below the optimum temperature, the reaction rate is too slow, resulting in an inefficient NO_x reduction and too high ammonia slip. Above the optimum temperature, the oxidation of ammonia to NO_x is getting significantly high and the process tends to produce NO_x instead of decreasing it.

Siemens Process Analytics at a glance

Products

Siemens Process Analytics

Siemens Process Analytics is a leading provider of process analyzers and process analysis systems. We offer our global customers the best solutions for their applications based on innovative analysis technologies, customized system engineering, sound knowledge of customer applications and professional support. And with Totally Integrated Automation (TIA), Siemens Process Analytics is your qualified partner for efficient solutions that integrate process analysers into automations systems in the process industry.

From demanding analysis tasks in the chemical, oil & gas and petrochemical industry to combustion control in power plants to emission monitoring at waste incineration plants, the highly accurate and reliable Siemens gas chromatographs and continuous analysers will always do the job.

Siemens process Analytics offers a wide and innovative portfolio designed to meet all user requirements for comprehensive products and solutions.

Our Products

The product line of Siemens Process Analytics comprises extractive and in-situ continuous gas analyzers (fig. 14 to 17), process gas chromatographs (fig. 18 to 21), sampling systems and auxiliary equipment. Analyzers and chromatographs are available in different versions for rack or field mounting, explosion protection, corrosion resistant etc.

A flexible networking concept allows interfacing to DCS and maintenance stations via 4 to 20 mA, PROFIBUS, Modbus, OPC or industrial ethernet.



Fig. 14: Series 6 gas analyzer (rack design)

| Extractive Continuous Gas Analyzers (CGA) | |
|---|---|
| ULTRAMAT 23 | The ULTRAMAT 23 is a cost-effective multicomponent analyser for the measurement of up to 3 infrared sensitive gases (NDIR principle) plus oxygen (electrochemical cell). The ULTRAMAT 23 is suitable for a wide range of standard applications. Calibration using ambient air eliminates the need of expensive calibration gases. |
| CALOMAT 6/62 | The CALOMAT 6 uses the thermal conductivity detection (TCD) method to measure the concentration of certain process gases, preferably hydrogen. The CALOMAT 62 applies the TCD method as well and is specially designed for use in application with corrosive gases such as chlorine. |
| OXYMAT 6/61/64 | The OXYMAT 6 uses the paramagnetic measuring method and can be used in applications for process control, emission monitoring and quality assurance. Due to its ultrafast response, the OXYMAT 6 is perfect for monitoring safety-relevant plants. The corrosion-proof design allows analysis in the presence of highly corrosive gases. The OXYMAT 61 is a low-cost oxygen analyser for standard applications. The OXYMAT 64 is a gas analyzer based on ZrO ₂ technology to measure smallest oxygen concentrations in pure gas applications. |
| ULTRAMAT 6 | The ULTRAMAT 6 uses the NDIR measuring principle and can be used in all applications from emission monitoring to process control even in the presence of highly corrosive gases. ULTRAMAT 6 is able to measure up to 4 infrared sensitive components in a single unit. |
| ULTRAMAT 6 / OXYMAT 6 | Both analyzer benches can be combined in one housing to form a multicomponent device for measuring up to two IR components and oxygen. |
| FIDAMAT 6 | The FIDAMAT 6 measures the total hydrocarbon content in air or even in high-boiling gas mixtures. It covers nearly all requirements, from trace hydrocarbon detection in pure gases to measurement of high hydrocarbon concentrations, even in the presence of corrosive gases. |
| In-situ Continuous Gas Analyzer (CGA) | |
| LDS 6 | LDS 6 is a high-performance in-situ process gas analyser. The measurement (through the sensor) occurs directly in the process stream, no extractive sample line is required. The central unit is separated from the sensor by using fiber optics. Measurements are carried out in real-time. This enables a pro-active control of dynamic processes and allows fast, cost-saving corrections. |

Fig. 15: Product scope „Siemens Continuous Gas Analyzers“



Fig. 16: Series 6 gas analyzer (field design) Fig. 17: LDS 6 in-situ laser gas analyzer

Siemens Process Analytics at a glance Products (continued) and Solutions



Fig. 18: MAXUM edition II Process GC



Fig. 19: MicroSAM Process GC

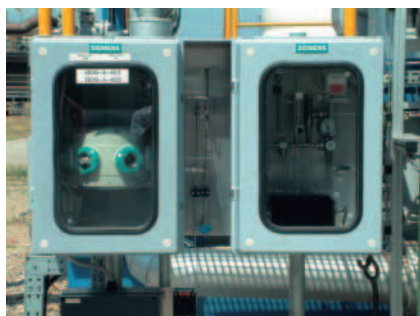


Fig. 20: SITRANS CV Natural Gas Analyzer

| Process Gas Chromatographs (Process GC) | |
|---|---|
| MAXUM edition II | MAXUM edition II is very well suited to be used in rough industrial environments and performs a wide range of duties in the chemical and petrochemical industries and refineries. MAXUM II features e. g. a flexible, energy saving single or dual oven concept, valveless sampling and column switching, and parallel chromatography using multiple single trains as well as a wide range of detectors such as TCD, FID, FPD, PDHID, PDECD and PDPID. |
| MicroSAM | MicroSAM is a very compact explosion-proof micro process chromatograph. Using silicon-based micromechanical components it combines miniaturization with increased performance at the same time. MicroSAM is easy to use and its rugged and small design allows mounting right at the sampling point. MicroSAM features drastically reduced cycle times, provides valveless sample injection and column switching and saves installation, maintenance, and service costs. |
| SITRANS CV | SITRANS CV is a micro process gas chromatograph especially designed for reliable, exact and fast analysis of natural gas. The rugged and compact design makes SITRANS CV suitable for extreme areas of use, e.g. offshore exploration or direct mounting on a pipeline. The special software "CV Control" meets the requirements of the natural gas market, e.g. custody transfer. |

Fig. 21: Product scope „Siemens Process Gas Chromatographs“

Our solutions

Analytical solutions are always driven by the customer's requirements. We offer an integrated design covering all steps from sampling point and sample preparation up to complete analyser cabinets or for installation in analyser shelters (fig. 22). This includes also signal processing and communications to the control room and process control system.

We rely on many years of world-wide experience in process automation and engineering and a collection of specialized knowledge in key industries and industrial sectors. We provide Siemens quality from a single source with a function warranty for the entire system.

Read more in "Our Services".



Fig. 22: Analyzer house (shelter)

Siemens Process Analytics at a glance Solutions (continued) and Services

Our solutions ...

Analyzer networking for data communication

Engineering and manufacturing of process analytical solutions increasingly comprises "networking". It is getting a standard requirement in the process industry to connect analyzers and analyzer systems to a communication network to provide for continuous and direct data transfer from and to the analysers.

The two objectives are (fig. 24):

- To integrate the analyzer and analyzer systems seamless into the PCS / DCS system of the plant and
- To allow direct access to the analyzers or systems from a maintenance station to ensure correct and reliable operation including preventive or predictive maintenance (fig.23).

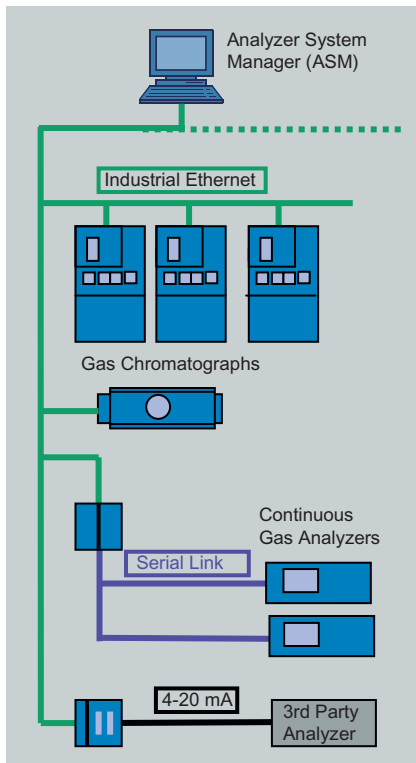


Fig. 23: Communication technologies

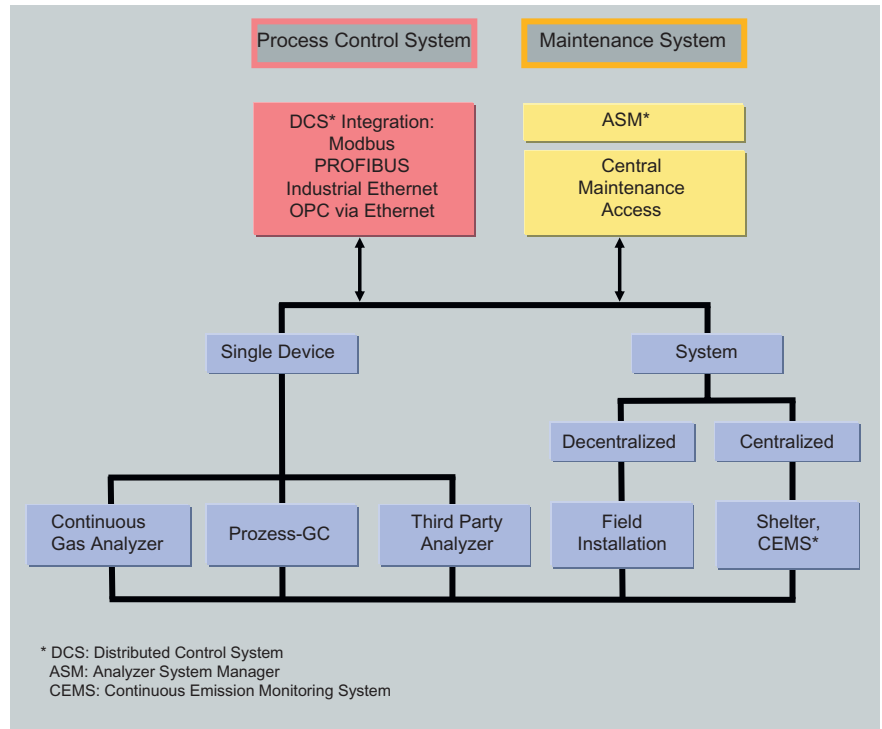


Fig. 24: Networking for DCS integration and maintenance support

Siemens Process Analytics provides networking solutions to meet the demands of both objectives.

Our Services

Siemens Process Analytics is your competent and reliable partner world wide for Service, Support and Consulting.

Our resources for that are

- Expertise
As a manufacturer of a broad variety of analyzers, we are very much experienced in engineering and manufacturing of analytical systems and analyzer houses. We are familiar with communication networks, well trained in service and maintenance and familiar with many industrial processes and industries. Thus, Siemens Process Analytics owns a unique blend of overall analytical expertise and experience.

- Global presence
With our strategically located centers of competence in Germany, USA, Singapore, Dubai and Shanghai, we are globally present and acquainted with all respective local and regional requirements, codes and standards. All centers are networked together.



Fig. 25: Portfolio of services

Siemens Process Analytics at a glance

Services, continued

Our Services ...

Service portfolio

Our wide portfolio of services is segmented into Consulting, Support and Service (fig. 25 to 26). It comprises really all measures, actions and advises that may be required by our clients throughout the entire lifecycle of their plant. It ranges from site survey to installation check, from instruction of plant personnel to spare part stock management and from FEED for Process Analytics (see below) to internet-based service Hotline.

Our service and support portfolio (including third-party equipment) comprises for example:

- Installation check
- Functionality tests
- Site acceptance test
- Instruction of plant personnel on site
- Preventive maintenance
- On site repair
- Remote fault clearance
- Spare part stock evaluation
- Spare part management
- Professional training center
- Process optimisation
- Internet-based hotline
- FEED for Process Analytics
- Technical consulting

FEED for Process Analytics

Front End Engineering and Design (FEED) is part of the planning and engineering phase of a plant construction or modification project and is done after conceptual business planning and prior to detail design. During the FEED phase, best opportunities exist for costs and time savings for the project, as during this phase most of the entire costs are defined and changes have least impact to the project. Siemens Process Analytics holds a unique blend of expertise in analytical technologies, applications and in providing complete analytical solutions to many industries.

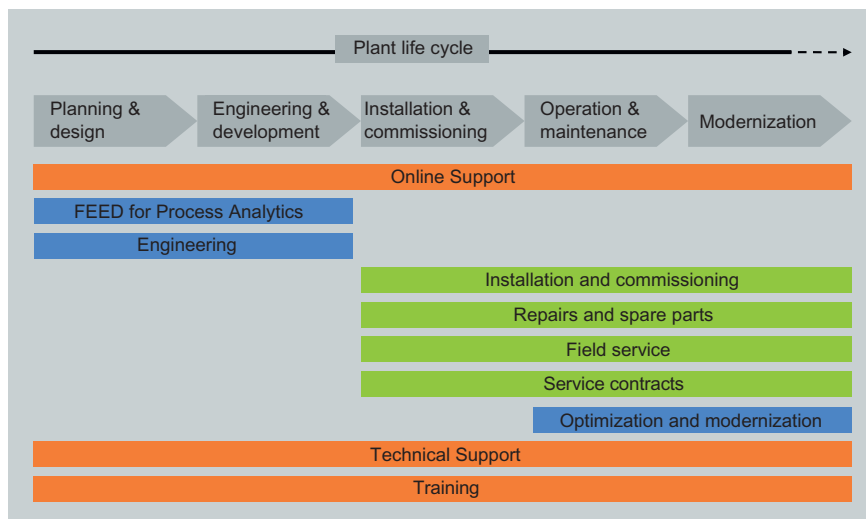


Fig. 26: Portfolio of services provided by Siemens Process Analytics

Based on its expertise in analytical technology, application and engineering, Siemens Process Analytics offer a wide scope of FEED services focused on analysing principles, sampling technologies, application solutions as well as communication system and given standards (all related to analytics) to support our clients in maximizing performance and efficiency of their projects.

Whether you are plant operators or belong to an EPC Contractor you will benefit in various ways from FEED for Process Analytics by Siemens:

- Analytics and industry know how available, right from the beginning of the project
- Superior analyzer system performance with high availability
- Established studies, that lead to realistic investment decisions
- Fast and clear design of the analyzer system specifications, drawings and documentation
- Little project management and coordination effort, due to one responsible contact person and less time involvement

- Additional expertise on demand, without having the costs, the effort and the risks of building up the capacities
- Lowest possible Total Costs of Ownership (TCO) along the lifecycle regarding investment costs, consumptions, utilities supply and maintenance.

Case Study

Siemens Process Analytics - Answers for industry



If you have any questions, please contact your local sales representative or any of the contact addresses below:

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