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We create chemistry

# Claus Catalysts and Tail Gas Treatment Solutions for Sulfur Recovery



# BASF Sulfur Recovery Overview

**BASF Claus Catalysts and Tail Gas Treatment Solutions** combine the strength of BASF, the global leader in catalysis, with the **experience** and **expertise** of our chemists and engineers.

Our dedication to the sulfur recovery process results in high-quality products, proven technologies, and reliable services that meet and exceed our customer's expectations and requirements. If you are looking for a manufacturer who knows how to make the right reaction happen, trust BASF Claus Catalysts and Tail Gas Treatment Solutions.



Over 40 years of experience



Comprehensive product line



Global customer service and technical support



## Introduction

Sulfur recovery is an important process for natural gas processing plants and refineries. The raw feed streams often contain gases, such as H<sub>2</sub>S and CO<sub>2</sub>. H<sub>2</sub>S is a highly toxic gas and contributes to SO<sub>2</sub> emissions. To comply with environmental regulations, the sulfur species are converted to elemental sulfur and water via sulfur recovery technologies (Figure 1).

## Sulfur Recovery Unit (SRU)

Typically, acid gases, removed from natural gas, and refinery sour gases are sent to a Claus SRU. In the Claus Unit, sulfur is recovered via thermal and catalytic stages (Figure 2). The reaction furnace converts 60-70% of H<sub>2</sub>S to elemental sulfur in the thermal stage. Multiple catalytic converters with Claus Catalysts increase sulfur recovery beyond 95% in the catalytic stages.

## Tail Gas Treatment Units (TGTUs)

A TGTU further reduces the sulfur content in the Claus tail gas to meet more stringent requirements on sulfur emissions. Of the multiple TGTU types and their various configurations, two types are shown in Figure 1. Through different processes, these TGTUs convert residual sulfur species in the tail gas to elemental sulfur and remove it to achieve a higher rate of sulfur recovery.

Figure 1. Block flow diagram for sulfur recovery consisting of a SRU and TGTUs.

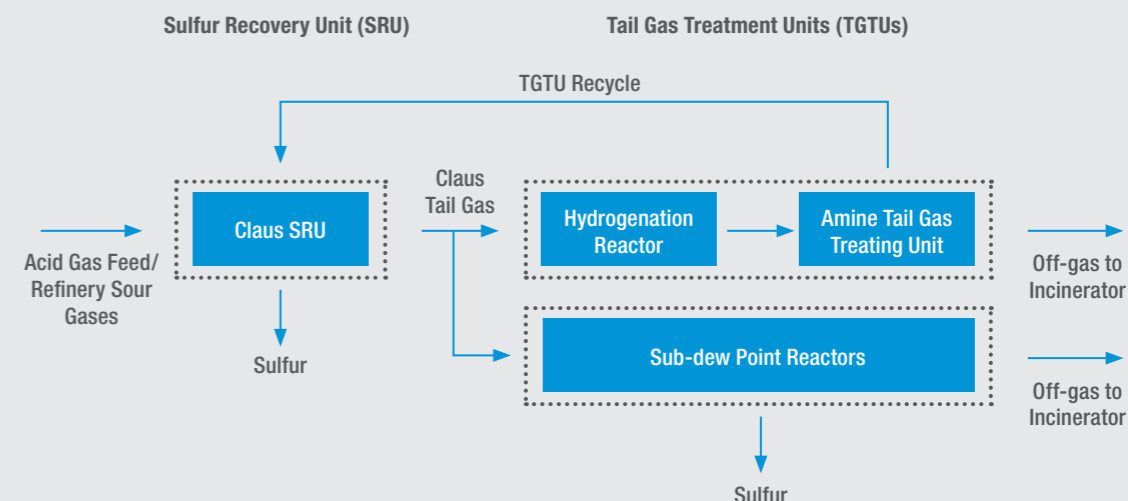
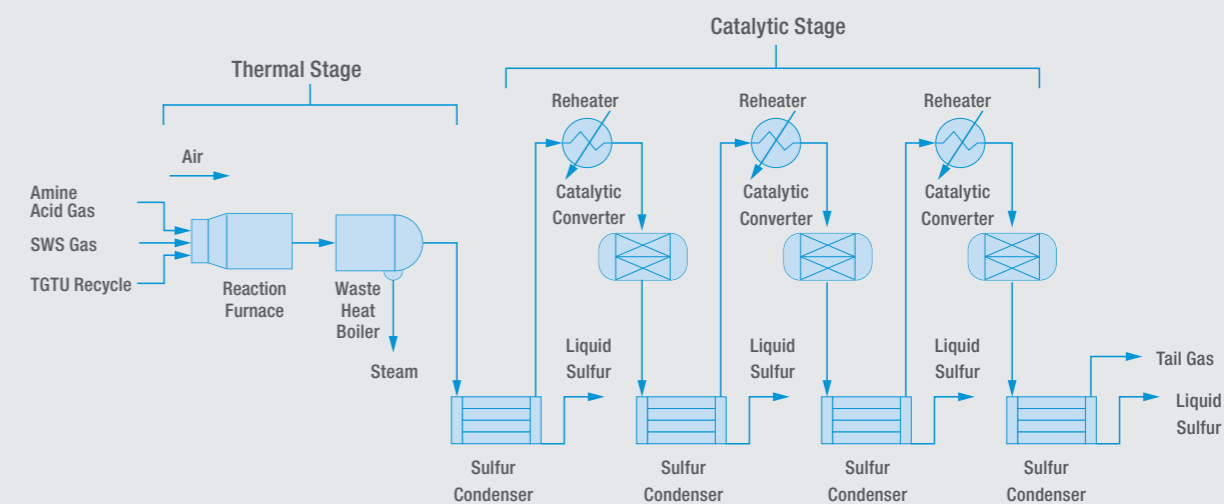


Figure 2. Schematic of a modified Claus SRU based on the straight-through configuration.



# BASF Claus Catalysts Portfolio

BASF has the most extensive line of Claus Catalysts in the industry from one provider. In addition to non-promoted and promoted activated alumina catalysts, we offer titania catalyst and active and inert bed supports. BASF Claus Catalysts provide the quality needed for maximizing the performance of the SRU.

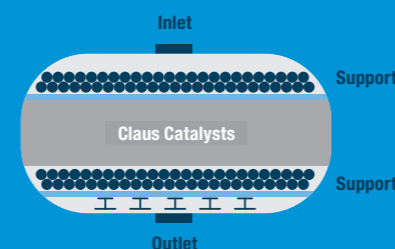
Catalyst production since 1983

Comprehensive product line

Superior catalysts to meet your requirements

## Applications and Benefits

- Maximum H<sub>2</sub>S, CS<sub>2</sub>, COS, and SO<sub>2</sub> conversion in the catalytic converters of the Claus process under various conditions
- Optimal catalyst for every condition and stream
- Low abrasion and high strength to minimize dust and fines
- Uniform size and shape for lower pressure drops



## Product Overview

Catalyst Type	Product Name	Characteristics
Activated Alumina	<b>DD-431</b> 3/16" (4.8 mm)	<ul style="list-style-type: none"> <li>■ High surface area with tailored pore size distribution for enhanced Claus activity</li> <li>■ Excellent Claus catalyst for common SRUs and sub-dew point reactors</li> </ul>
Promoted Alumina	<b>DD-831</b> 3/16" (4.8 mm)	<ul style="list-style-type: none"> <li>■ Improved resistance to deactivation</li> <li>■ High COS hydrolysis for a longer time period than pure alumina catalysts</li> </ul>
	<b>S-100 SR</b> 3/16" (4.8 mm)	<ul style="list-style-type: none"> <li>■ High surface area to scavenge free oxygen and prevent sulfation</li> <li>■ Extreme advantage for Claus plants using direct reheat</li> </ul>
Titania	<b>Ti-1100e</b> 1/8" (3.2 mm)	<ul style="list-style-type: none"> <li>■ High titanium dioxide content for conversion reactions</li> <li>■ Improved conversion of COS and CS<sub>2</sub> at lower operating temperatures which reduces the load on the TGTU</li> <li>■ Resistant to deactivation</li> </ul>
Bed Supports	<b>Active Bed Support (ABS)</b>	<ul style="list-style-type: none"> <li>■ Extremely effective in preventing catalyst deactivation and catalyst bed plugging</li> <li>■ Additional catalytic activity for Claus reactions compared to an inert bed support</li> </ul>
	<b>Ceramic Bed Support (C-167)</b>	<ul style="list-style-type: none"> <li>■ High resistance to mechanical and thermal shock</li> <li>■ Chemically inert, robust bed support</li> </ul>

\*Most catalysts and bed supports are available in other sizes.

# BASF Tail Gas Treatment Solutions Portfolio

BASF offers Tail Gas Treatment Solutions to increase sulfur recovery from Claus tail gas. The solutions include catalysts and technologies that are proven for sulfur recovery to achieve the desired performance and meet environmental requirements.

Capable of achieving over 99.9% recovery of sulfur

Cost-effective technology to meet new regulations

Versatile technology for various configurations

## Applications and Benefits

- Hydrogenation of any remaining sulfur species to H<sub>2</sub>S with a CoMo type catalyst
- Selective removal of H<sub>2</sub>S using OASE<sup>®</sup> yellow, ExxonMobil FLEXSORB<sup>™</sup>, and OASE<sup>®</sup> sulfexx<sup>™</sup> technologies
- Cost-effective solutions to meet CAPEX/OPEX requirements

## Hydrogenation Reactor

### CoMo Catalyst

- Hydrogenation of sulfur species CS<sub>2</sub>, COS, SO<sub>2</sub> and S<sub>x</sub> in feed to reactor
- Different shapes and sizes for a low pressure drop
- Long and stable performance
- Low temperature operation

## Amine Tail Gas Treating Unit

### OASE<sup>®</sup> yellow Technology

- Selective removal of H<sub>2</sub>S
- Easy to swap from MDEA based solvent in TGTUs
- Lower solvent circulation rates for lower energy consumption
- Increased acid gas capacity
- Noncorrosive and nontoxic solvents

### FLEXSORB<sup>™</sup> Technology

- Highly selective removal of H<sub>2</sub>S
- Very high CO<sub>2</sub> rejection
- Lower recirculation rates and lower energy consumption
- Lower corrosion
- Uses conventional equipment and simple to operate
- Suitable for high ambient temperatures
- Lower the SRU CAPEX/OPEX

### OASE<sup>®</sup> sulfexx<sup>™</sup> Technology

- Ultra-selective removal of H<sub>2</sub>S as low as 10 ppmv
- Eliminate the need for chiller unit
- Energy savings of 15% versus FLEXSORB<sup>™</sup> Technology
- No equipment changes
- Low carbon footprint



OASE<sup>®</sup> is a registered trademark of BASF.  
FLEXSORB<sup>™</sup> is a trademark of ExxonMobil.  
Sulfexx<sup>™</sup> is a trademark of BASF.

# BASF Technical Support Service

BASF's state-of-the-art Claus Catalysts and Tail Gas Treatment Solutions are backed up by the best technical support in the industry. BASF understands that technical support and service are paramount for achieving customer success. We are dedicated to offering solutions that work together with our outstanding customer service and technical support.

**Our promise:** With worldwide experience and expertise, BASF's technical support team delivers high-quality, reliable support to help our customers optimize performance and maximize profitability.

## Some of the most common services we provide include:

	<p>Computer simulation of new and existing Claus reactors</p>		<p>General guidelines for catalyst loading and unloading and startup and shutdown</p>
	<p>Recommendations of product and operational parameters to optimize plant performance and save costs</p>		<p>Technical seminars on catalyst usage and optimization</p>
	<p>Sample analysis of catalyst</p>		<p>Plant troubleshooting via phone, email, or plant visit, if necessary</p>

# BASF Technical Support Case Studies

## Case Study 1:

### Optimizing Catalyst Configuration

**Situation:** In a gas plant, the gas contained high COS/CS<sub>2</sub> concentrations that resulted in a low sulfur recovery of 99.29%.

**Solution:** BASF technical experts analyzed the operation and provided an optimized design with the first converter partially loaded with Ti1100e for a sulfur recovery of 99.61%.

**Impact:** The optimized design:

- Reduced emissions by 40%
- Required no capital investment
- Increased unit lifetime

**+0.3% = 6MT less SO<sub>2</sub>**

Increase in S recovery      emissions per day

## Case Study 2:

### Optimizing Amine Tailgas Treating

**Situation:** In a Tailgas Unit, the high H<sub>2</sub>S slip of the amine absorber of > 100 vppm lead to high SO<sub>2</sub> emissions at the refinery's stack.

**Solution:** BASF's OASE Gas Treatment team came up with solution to swap the existing MDEA solvent to OASE<sup>®</sup> yellow while the unit was in operation. A subsequent adjustment of the plant parameters in close cooperation with the refinery's operations has lead to substantial drop of the H<sub>2</sub>S concentration (< 50 vppm) and the SO<sub>2</sub> emissions, energy savings and lower amine make up.

**Impact:** The optimized design:

- Reduced SO<sub>2</sub> emissions by over 30%
- Cooling water and steam savings by over 15%





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## About Us

BASF's Catalysts division is the world's leading supplier of environmental and process catalysts. The group offers exceptional expertise in the development of technologies that protect the air we breathe, produce the fuels that power our world and ensure efficient production of a wide variety of chemicals, plastics and other products, including advanced battery materials. By leveraging our industry-leading R&D platforms, passion for innovation and deep knowledge of precious and base metals, BASF's Catalysts division develops unique, proprietary solutions that drive customer success.

## BASF – We create chemistry

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