



**CATALYTIC SYSTEMS FOR
AMMONIA OXIDATION**

YOUR GLOBAL PARTNER FOR CATALYTIC GAUZES

Catalytic systems are widely used for industrial ammonia oxidation. As an expert for platinum group metals, Heraeus is industry-leading in the production of catalytic gauzes and focuses its activities on providing products and services for this industry. By working closely with our customers during the whole life cycle of their product, we achieve constant improvement for their benefit and best outcome. Our customer is our partner. We value long-term relationships and know our customers well in order to serve them in an ideal way.



Catalytic gauzes from Heraeus

OUR PRODUCT PORTFOLIO

Heraeus' systems are based on varying physical parameters and metal alloys in different gauze layers. The gauzes of these catalytic systems are made up of fine wires which are knitted to create 3D structures. They are tailored according to operating conditions of a specific plant and to market requirements perceived by the customer.

FTC FLEX SYSTEM

The Heraeus "Functional Total Control (FTC) system" is a concept for the catalytic oxidation of ammonia. Using computer models like Computational Fluid Dynamics (CFD), a fully integrated package is designed to save money for the customer. The system helps to tackle following common obstacles:

CORRUGATED SYSTEMS

Heraeus has extensive experience with the global use of corrugation in high pressure nitric acid reactors. With the wave-like shape of the corrugated gauzes, an increased surface area is obtained, which allows a gauze design with lower pressure drop and therefore with a higher production capacity.

- Surface area for reaction increased by up to 30% compared to flat gauze systems
- Lower pressure drop and therefore increased production capacity

With lower pressure drop, additional catchment layers can be added which will lead to significantly lower metal losses and operating costs. It is also possible to modify primary catalyst layers to increase campaign length.

FLEXIBLE CUSTOMIZATION

Heraeus not only supplies catalyst gauzes, but also advises customers on the best catalyst configuration, alloy, and structure. Optimized catalyst systems can be proposed to suit individual process parameters.

The gauze designs are determined by CFD simulation software. By entering the specific customer requirements, most suitable gauze system is computed.

By studying the catalyst reaction kinetics, the gas flow dynamics, and the changes of catalyst micro-surfaces during the operating time, Heraeus was able to improve the gauze systems, which are known today as FTC Flex.

OUR PRECIOUS METALS LOOP FOR CHEMICAL CATALYSTS

PRECIOUS METALS SOURCING & LOGISTIC SERVICES



CATALYST RECOMMENDATION AND SUPPLY



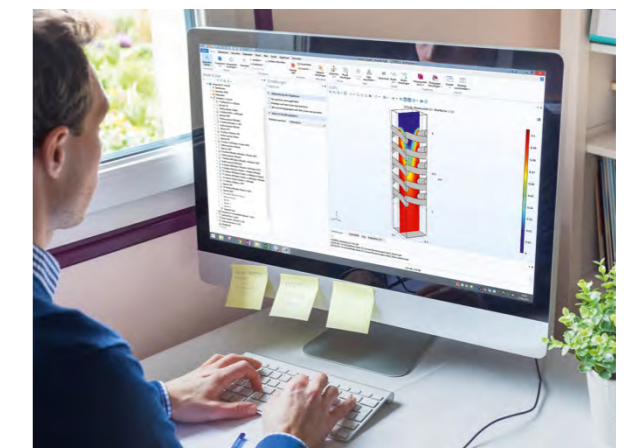
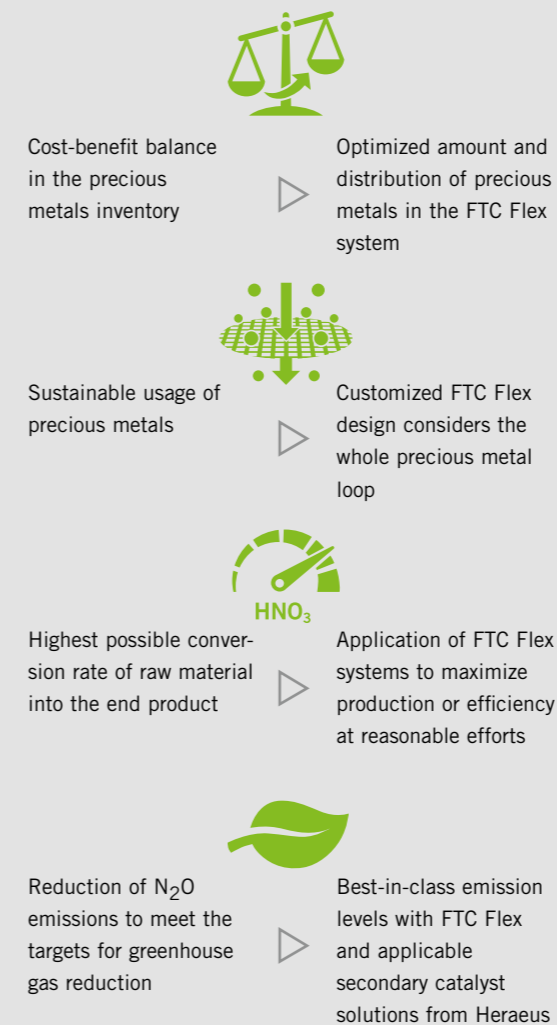
RECYCLING & REFINING



INDUSTRIAL APPLICATION OF CATALYST



CUSTOMER CHALLENGE ▶ HERAEUS' SOLUTION



CFD simulation of FTC Flex design

Avoiding N₂O Emissions

When ammonia is oxidized to produce caprolactam, ending up in nylon fibres, or nitric acid for fertilizers and explosives, the process releases N₂O into the atmosphere as a byproduct. This greenhouse gas has 310 times the global warming potential of carbon dioxide and is therefore a major factor in global warming. More than 60 million tons of nitric acid are produced around the world annually, with an estimated 500,000 tons of nitrous oxide generated as a byproduct – equivalent to the carbon dioxide emissions from over 60 million mid-sized cars.

Heraeus has developed primary and secondary solutions to reduce N₂O emissions significantly by over 90%. Contact our experts for further information on our gauze systems and secondary catalysts for N₂O reduction.



Nylon spools



Application of fertilizer

OUR SERVICES AND TECHNICAL SUPPORT

Heraeus is your partner for a complete solution. Thanks to our long-standing experience in process performance, we can offer a wealth of knowledge. It is our goal to achieve constant improvement through close cooperation with our customers before, during and after the use of our products. We assist the customer with technical support to optimize processes and are quick to respond to their site in emergency situations.

SERVICES

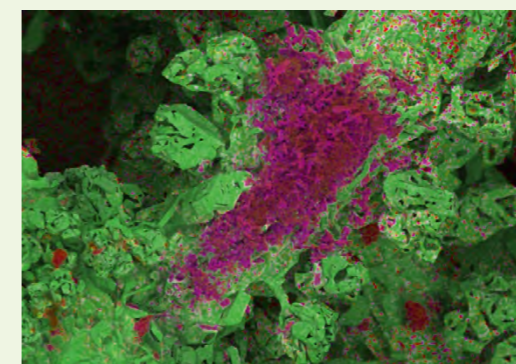
PLANT CLEANING

In modern plants, substantial amounts of precious metal catalysts are retained in the heat recovery train, and large quantities of precious metals can be recovered from spent heat exchangers. Also, there are various non-destructive cleaning methods which enable the recovery of precious metals during normal plant turnarounds or stoppages, while also improving heat transfer and plant throughput.

METAL MANAGEMENT AND LEASING

Heraeus offers not only the physical precious metal cycle but also a comprehensive precious metal management service.

- 24-hour worldwide trading and acquisition of precious metals
- Precious metal handling via customer metal accounts
- Financing models available to the customer include leasing or buying precious metals



Surface analysis of used gauzes
(200-fold magnification. Green = Pt; other colors = impurities)



Analytical facilities

REFINING OF USED GAUZES SYSTEM

As specialists in the handling of spent precious metal catalysts, we offer precious metal recovery with the highest quality. The reclaimed precious metal can be used again for the manufacture of new gauzes.

TECHNICAL SUPPORT

PROCESS OPTIMIZATION IN CUSTOMER PLANTS

In order to ensure process optimization, Heraeus offers the option to perform a run evaluation on the production campaign. Numerous process performance data are monitored in a standardized data bank. After each campaign, the process parameters are evaluated and, if necessary, methods of improving performance are demonstrated and conducted. These can include: Increasing conversion efficiency and/or production capacity, reducing metal losses, increasing campaign length, reducing N₂O emissions. This is a stepwise approach to process performance improvement, in collaboration with the customer.

INVESTIGATION REPORTS

Samples of used gauzes are taken and analyzed for contamination on the surface of the gauzes. Contaminants can include: Catalyst poisons, carbon layers and Rhodium Oxide formation. The results of the investigation are summarized in an investigation report with the goal of reducing the amount of contamination and therefore increasing conversion efficiency. We routinely use a wide range of powerful investigation techniques. The most commonly used technique is Scanning Electron Microscopy (SEM) in conjunction with Energy Dispersive X-Ray Analysis (EDXA). With these methods the morphology of the catalyst and the composition of surface contaminants can be quickly investigated on small scale samples.

- In more demanding situations, other techniques such as Auger Electron Spectrometry (AES) and Secondary Ion Mass Spectroscopy (SIMS) can be used for surface analysis and sub-surface profiling.
- These methods are further supplemented by bulk material analysis techniques such as X-Ray Fluorescence Analysis (XRFA) and directly and inductively Coupled Plasma Optical Emission Spectrometry (DCP and ICP-OES).

INSTALLATION OF GAUZE SYSTEMS INTO THE BURNER TOGETHER WITH THE CUSTOMER

TROUBLESHOOTING

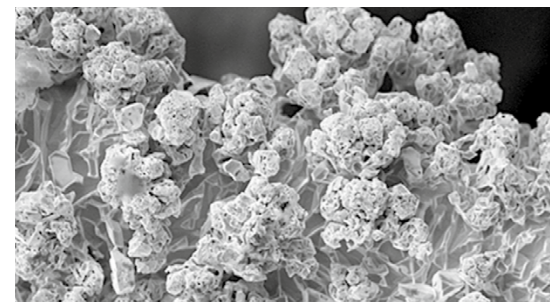
Heraeus provides a troubleshooting service to customers in addition to the use of its products and services. This service includes consultations by phone or on-site and is aimed at solving any problem which may occur like performance loss and increasing N₂O emissions.

TEST FACILITIES FROM COOPERATION PARTNER INSTITUTE INS PULAWY

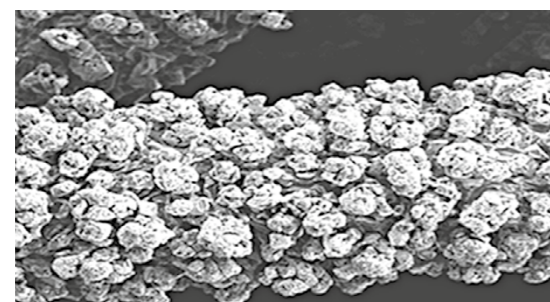
At the pilot plant from partner institute INS Pulawy, Heraeus has the opportunity to test FTC gauzes and N₂O abatement catalysts under specific process conditions on a pilot scale. This pilot plant gives the customer an additional tool for improving the performance of their process.

ENGINEERING SERVICE

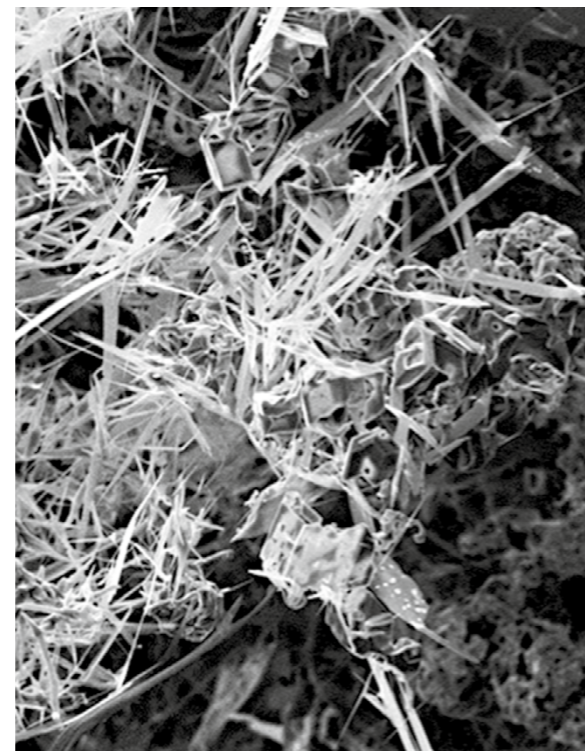
Heraeus has partnerships for reviewing all equipment related to the reactor and the catalyst basket with an experienced team. If necessary, a CFD simulation of the flow distribution in the burner is conducted. After basic and detailed engineering drawings, the necessary equipment/parts are manufactured and shipped to customer's site. Then, for example, a new basket is installed/assembled into the burner so that the necessary amount of N₂O abatement catalyst can be installed to reach the N₂O abatement regulations.



Gauze without Rhodium Oxide



Cauliflower structure of Heraeus FTC gauzes



Gauze with Rhodium Oxide

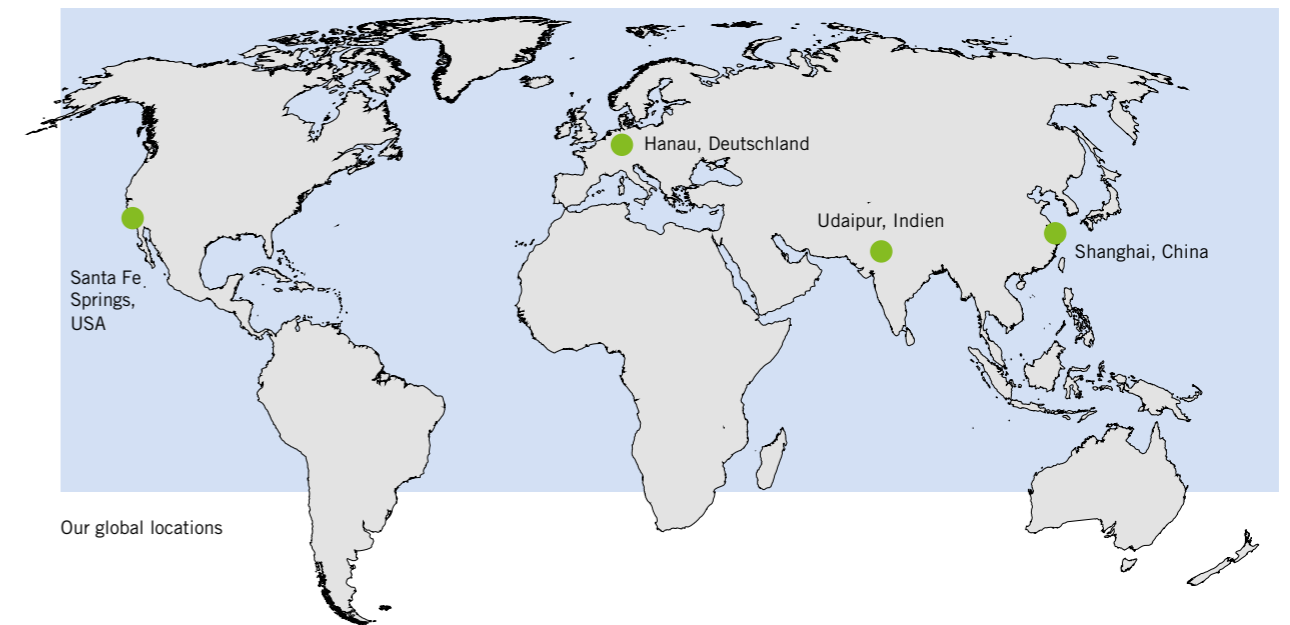
COMPLIANCE

For our customers, Heraeus is a trusted partner that clears the path for environmental protection, regulatory compliance and resource conservation. Our stringent supply chain policy ensures sourcing of metals from legitimate and ethical sources.

All of our major production facilities comply with governmental, federal, state and municipal laws and regulations and are ISO 9001 and 14001 certified to Quality and Environmental Management Standards.

WORLDWIDE PRESENCE

With our global positioning in Germany, the U.S., India and China, we are able to produce within our customers' customs borders, and provide on-site technical support – with the same quality all over the world.



Our global locations

ABOUT HERAEUS

Heraeus, the technology group headquartered in Hanau, Germany, is a leading international family-owned company formed in 1851. With expertise, a focus on innovations, operational excellence and an entrepreneurial leadership, we strive to continuously improve the businesses of our customers around the world.

The Global Business Unit **HERAEUS PRECIOUS METALS** is a leading provider of precious metals services and products. We combine all activities related to our comprehensive expertise in the precious metals loop – from trading to precious metals products to recycling.

We are one of the world's largest refiners of platinum group metals (PGMs) and a leading name in industrial precious metals trading. Our precious metals products are used in a wide variety of industries, including the chemical, pharmaceutical, glass, electronics and automotive industries. We offer top quality solutions and products based on many years of experience and technical expertise. We are a reliable development partner for our customers and find the best solutions for their requirements.

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