



**umicore**

Fuel Cell & Stationary Catalysts

Comply without compromise

# DNX<sup>®</sup> SCR catalysts and technologies

High-performance DeNO<sub>x</sub> catalysts and efficient SCR system designs



Umicore is a global materials technology and recycling group with over 11,000 employees and a turnover of €17.5 billion in 2019. We generate the majority of our revenues and dedicate most of our R&D efforts to clean technologies. These include emission control catalysts, materials for rechargeable batteries and recycling.

Umicore's overriding goal of sustainable value creation is based on an ambition to develop, produce and recycle materials in a way that fulfils its mission: materials for a better life.



# Comprehensive solutions for DeNOx applications

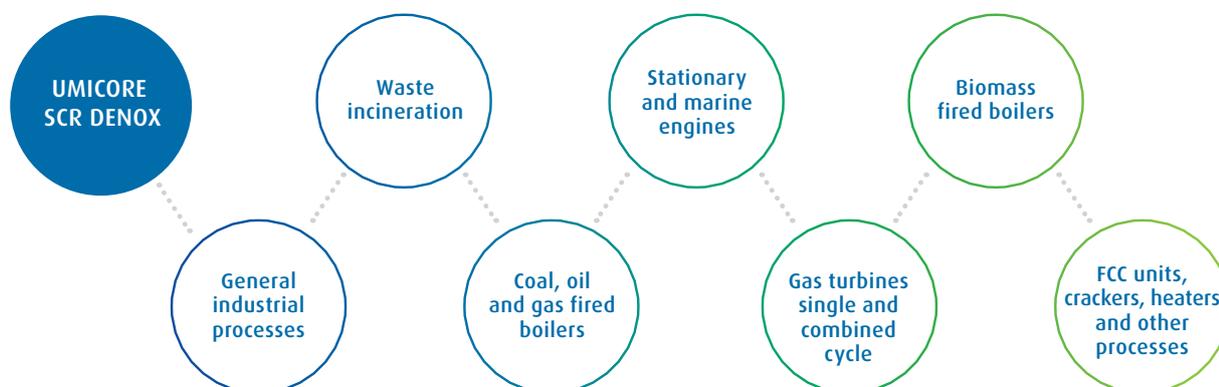
Reduce NOx by up to 99% with proven Umicore technology

*Complying with emission standards without compromising performance or profitability is a challenge many industries are facing.*

With decades of broad experience, Umicore DNX® SCR catalysts and system designs are meeting the challenge for customers around the world. For stationary

applications, our high-efficiency solutions can reduce NOx by up to 99% with maximum reliability, even when operating under severe conditions.

## The scope of SCR DeNOx products and services



### Benefits at a glance:

1. Our SCR process designs have been implemented at over 2,000 sites worldwide
2. Our engineering services make sure the value of investments is maximized
3. CFD and cold flow modeling enable us to ensure low pressure drop, efficient ammonia mixing, and uniform gas distribution
4. Our technical services help optimize performance and manage catalyst replacement

### Our Services include:

- SCR system management including onsite inspections, performance assessments, and assistance with catalyst regeneration or disposal
- Catalyst sample retrieval, activity testing, accumulated poison analysis and remaining service life projection
- On-site advisory services during installation etc.
- On-site troubleshooting, including emissions testing and AIG tuning

# DNX<sup>®</sup> SCR catalysts

Proven solutions for all industrial applications

*Umicore DNX<sup>®</sup> catalysts are widely recognized for their superior NO<sub>x</sub> removal capabilities and extremely low SO<sub>2</sub> oxidation rate.*

A fiberglass-reinforced titania carrier and corrugated shape secure exceptional mechanical strength and low gas pressure loss. A wide range of pitch sizes and chemical formulations mean we can provide the optimal catalyst for all applications.

## NO<sub>x</sub> reduction

Our DNX<sup>®</sup> catalysts remove NO<sub>x</sub> in exhaust gases from boilers, combustion turbines, gas and diesel engines, incinerators, refineries, and chemical units.

To handle dust-laden gases from coal-fired boilers and poisonous components in fly ash and flue gas – including biofuels – we offer special high-dust catalyst formulations. Long-term experience with DNX<sup>®</sup> on coal-fired boilers has furthermore demonstrated more than 90% mercury oxidation, allowing users to meet

existing and upcoming regulations on mercury emissions.

The DNX<sup>®</sup> dual function DNO and GTC series add powerful CO and VOC oxidation to our proven DeNO<sub>x</sub> capabilities in combustion turbine applications, FCC units, biomass, engines, cement and other industrial systems and fueled power plants such as wood-burning plants. Unlike traditional oxidation catalysts, Umicore's dual function catalysts is unique in that it does not significantly increase SO<sub>2</sub> oxidation, even at low SO<sub>2</sub> concentrations.

## Main benefits

- Up to 99% NO<sub>x</sub> removal with low to zero ammonia slip
- Very low SO<sub>2</sub> oxidation
- High tolerance for catalyst poisons
- Excellent, proven mercury oxidation capabilities
- Long service life



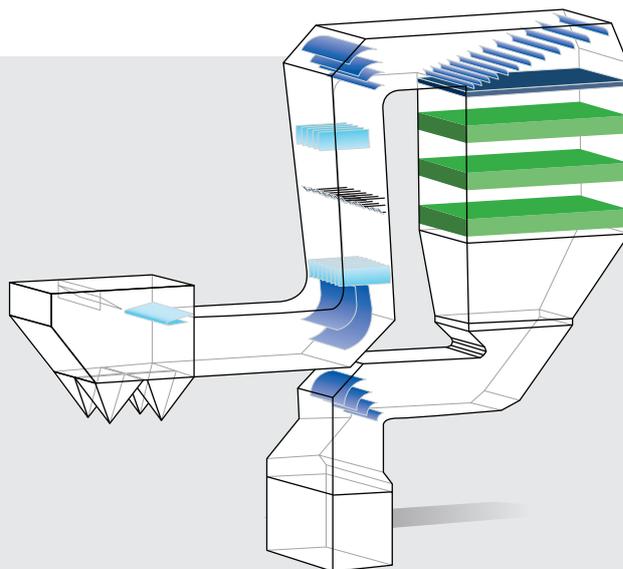
# SCR system designs

Optimized technologies work hand in hand with our catalysts

For any DeNO<sub>x</sub> catalyst to perform optimally, systems for ammonia injection and mixing need to be designed just right. Developed to bring out the very best in our DNX<sup>®</sup> catalysts, our system designs complete the DeNO<sub>x</sub> picture no matter which application.

## A specially designed gas mixing system

Our licensed specially designed gas mixer ensures superior mixing efficiency and very low pressure loss. Used with success in SCR units on coal-fired power plant boilers and at oil refineries, where NO<sub>x</sub> reduction requirements exceed 95%, our specially designed mixer is a great example of how our technologies enhance our market-leading catalyst performance.



## Complete technology package

From the first feasibility study to the final commissioning, Umicore offers complete technology packages which include our DNX<sup>®</sup> catalysts plus a Basic Engineering Package comprising of:

- Drawings of catalyst, catalyst arrangement, and sealing system
- CFD and physical flow model verification with test report including drawings
- Process specifications and drawings of the reactor, ammonia injection and mixing systems, and ammonia flow control unit
- Process flow diagrams plus piping and instrument diagrams
- Process description, including control principles
- Performance test procedure
- Review of a system design

By supplementing DNX<sup>®</sup> catalysts with a Basic Engineering Package, Umicore makes sure that all SCR processes are guaranteed with high performance.

# CASE

DNX<sup>®</sup> catalyst removes load constraints in gas turbine operation



## THE CHALLENGE

Located in Hood County, Texas, Exelon Corporation's Wolf Hollow Generating Station was constructed and went commercial in 2003. The power island consists of two MHI 501G turbines firing natural gas only, two Deltak HRSGs and one MHI steam turbine, and has a rated net capacity of 720 MW. In recent years, the plant has seen a greater need to operate at partial load, not only at night, but also during the day. Originally designed with no system for oxidizing CO to CO<sub>2</sub>, the plant's minimum load limit has been constrained by higher CO emission rates at reduced load. The obvious solution – installing a conventional CO oxidation system upstream of the AIG – would have entailed significant modifications and a loss of maximum output and thermal efficiency due to higher pressure drop.



## THE SOLUTION

Instead of a conventional CO oxidation system, Exelon management decided to install Umicore's dual function DNX<sup>®</sup> GTC-802 combined SCR/CO catalyst in the two units at Wolf Hollow. The catalyst was installed in October 2014, replacing the existing charge of Umicore SCR-only catalyst. Both units were shut down for about four days, while the previous catalyst was replaced with a single layer of the DNX<sup>®</sup> GTC-802. At 500 mm deep, the layer of new catalyst was only 25 mm deeper than the layer it had replaced, enabling the plant to oxidize 90% of the CO across the load range in addition to removing 90% of NO<sub>x</sub>, without increasing pressure drop.



## THE OUTCOME

The unit's performance has not changed since initial start-up. The CO oxidation rate remains at >96%, while DeNO<sub>x</sub> removal is over 90% with very low ammonia slip. The SO<sub>2</sub> to SO<sub>3</sub> oxidation rate is 10 times lower than traditional platinum catalyst at less than 1.0% – greatly reducing any chance of ABS fouling in the economizer section of the HRSG. Unlike platinum/alumina catalysts, the GTC-802 is very tolerant to the presence of sulfur in the fuel, and will never require acid washing to remove poisons. Finally, overall pressure drop is close to 50% lower than a traditional arrangement with separate layers of CO and SCR catalysts. Needless to say, the customer is very pleased with the new solution.

## Related technologies

### Particulate filtration and NO<sub>x</sub> removal combined

In certain industries, dust, soot and other particulates in off-gases are a problem that needs special consideration. Our solutions allow for integration of catalytic emission management in particulate filtration, reducing complexity and total cost of ownership. High efficiency catalytic filters offer new flexibility in meeting existing and future emission requirements.

### Discover the full range of Umicore catalysts and technologies for emissions control

Optimized performance often means ensuring that multiple technologies and components are tuned to each other. On the following pages are some related offerings from Umicore.

# CASE

The DNX® catalyst enables coal-fired power plant to overcome challenges posed by Texas lignite fuel



## THE CHALLENGE

Texas lignite is a high ash, low BTU and very erosive coal, mined mostly in central and northeastern Texas. Luminant, the largest electricity producer in Texas, wanted to install a SCR system in Unit 4 of its Sandow plant, located near the city of Rockdale. However, plant managers – and the industry at large – were concerned that the Texas lignite fuel would result in SCR catalyst erosion and plugging.



## THE SOLUTION

Sandow Unit 4 uses a Combustion Engineering tangentially fired supercritical boiler, and has a maximum continuous output of 640 MWe. After consulting with Umicore specialists, plant managers decided to install DNX® in the SCR system – creating the world's first commercial application of a SCR system on a boiler burning Texas lignite fuel.



## THE OUTCOME

The system was deployed in early 2010, and Umicore has remained the only catalyst supplier for Unit 4 ever since. Over years of operation, the SCR system has proven to be very reliable – with near zero catalyst erosion, no plugging and lower than expected deactivation.



### Why partner with Umicore:



The Umicore advantage lies not just in individual solutions, but in how our solutions work together.



We are a partner who – as catalyst provider, technology licensor and service provider – has a unique ability to look at the big picture and tailor solutions that are fully optimized to meet exact needs.



Partnering with us on a DeNO<sub>x</sub> solution provides the benefits of proven reliability and decades of industry experience.



We have vast experience delivering DeNO<sub>x</sub> process designs, catalysts and proprietary equipment across the full range of industries and specific applications.

For inquiries and additional  
information please contact

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