

Clean Technologies



Super GEAR™ the next generation MECS® hexa-lobed catalyst



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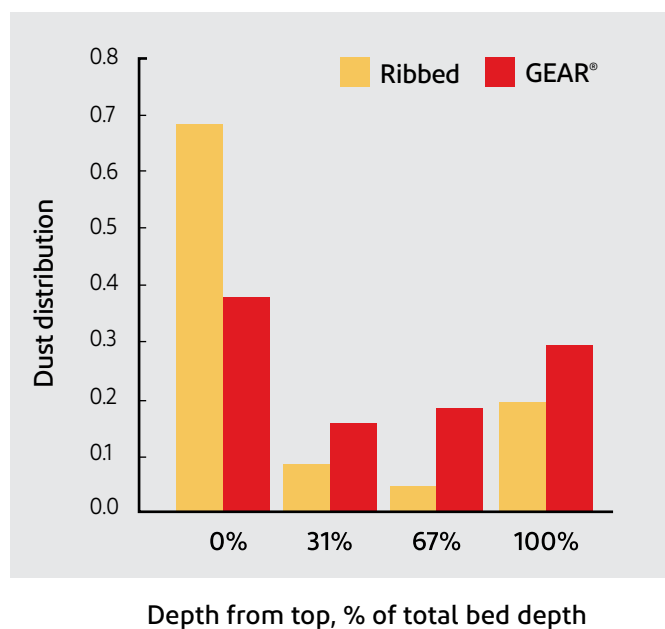
DuPont Clean Technologies' commitment to sulfuric acid research and innovation has resulted in a high performance MECS® catalyst that produces lower SO₂ emissions with increased production rates while providing energy savings and longer production cycles.

A breakthrough technology

MECS (now DuPont Clean Technologies) introduced GEAR® catalyst technology to the sulfuric acid industry in 2011. GEAR® catalyst (Geometrically optimized with Enhanced surface area,

improved Activity, and Reduced pressure drop) provides sulfuric acid plants with multiple benefits, thanks to its advanced formulation and unique undulating lobes which maximize effectiveness. When compared to a generic ribbed ring catalyst, GEAR® has better dust distribution throughout the full height of the catalyst bed (Figure 1). The benefit to the acid plant is the lower pressure drop buildup over time which extends bed life, reducing converter maintenance costs.

Figure 1. Comparison of dust distribution in catalyst beds after three years of operation



Shape optimization of GEAR®

When developing GEAR®, and ultimately Super GEAR™, the MECS® catalyst research team demonstrated that shape optimization could significantly improve the effectiveness of ribbed ring catalyst. A side by side simulation (Figure 2) of the concentration gradient of SO₂, as it diffuses and subsequently reacts in a ribbed ring and GEAR® catalyst, shows the improved rate of reaction of SO₂ within GEAR®. As can be seen, SO₂ concentration is higher at the surface of GEAR® catalyst, demonstrating an increased rate of migration of SO₂ into the body of the catalyst thereby increasing overall activity. When the ribbed ring shape is transformed into the more effective GEAR® shape and is combined with a superior formulation, Super GEAR® emerges.

MECS® catalyst innovations time line




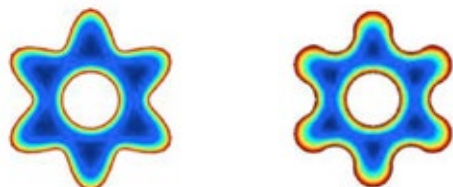
1925	1930	1963	1970	1978	1980	1989
<p>Manufacture of first sulfuric acid catalyst.</p> 	<p>Complete plant design, engineering and construction of sulfuric acid plants began.</p>	<p>Introduced a new larger pellet, T type, for lower pressure drop.</p> 	<p>Built the first interpass absorption plant in the USA.</p>	<p>Designed the first stainless steel converter for high SO₂ concentrated gas.</p>	<p>LP rings introduced for reduced pressure drops up to 50%.</p> 	<p>Introduced Cesium promoted catalyst to allow increased capacity and lower SO₂ emissions.</p>

Figure 2. Ribbed ring and hexa-lobe ring catalyst cross sections at 475°C and 11.0% SO₂



XLP-110

Super GEAR™

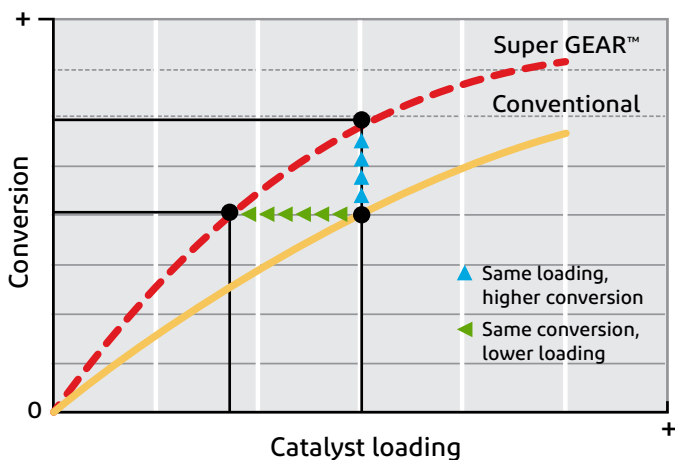
Color code = Orange: High SO₂ Deep blue: Low SO₂

What makes MECS® Super GEAR™ so super

► Highest activity

The advanced formulation of Super GEAR™ and unique hexa-lobed ring shape combine to elevate the catalyst activity compared to conventional ribbed-ring shaped catalyst. Achieve higher levels of conversion with the same amount of catalyst or the same conversion rate with less catalyst (Figure 3).

Figure 3. Performance comparison of Super GEAR™ and conventional catalyst



► Increased capacity, reduced emissions and capital cost

MECS® Super GEAR™ can lower emissions or increase capacity (Figure 4). Sulfuric acid plants now have the choice of reducing stack emissions, increasing sulfuric acid production, or both. On new plant builds, converter size can be significantly reduced, resulting in lower capital costs.

Figure 4. MECS® Super GEAR™ lowers emissions, increases capacity

	Base case	Partial replacement in Pass 3	Complete replacement in Passes 2 and 3
Pass 1	GR-330	GR-330	GR-330
Pass 2	XLP-110	XLP-110	Super GEAR™
Pass 3	XLP-110	Super GEAR™/XLP-110	Super GEAR™
Pass 4	SCX-2000	SCX-2000	SCX-2000
Relative volume	100%	100%	100%
Relative emissions	100%	70%	55%

MECS® Super GEAR™ R&D leadership and innovation

MECS® catalyst Research and Development has introduced many catalyst innovations to the sulfuric acid industry over the past 90 + years and as a result is today regarded as one of the foremost catalyst innovators in the world. Our staff of scientists and engineers continually work to deliver innovative and successful catalytic process solutions. Breakthrough catalyst technologies such as the new MECS® Super GEAR™ will address emissions, production and energy issues and further enable sulfuric acid plants to operate at peak environmental levels while serving stakeholder needs.

Use PeGASyS™ to maximize converter performance

To determine the MECS® Super GEAR™ attributes that can work best for your plant, PeGASyS™ technical service is key. A PeGASyS™ test collects data at many different points in the process and allows for a thorough analysis of the gas side of the sulfuric acid plant. Contact your MECS® catalyst engineer, or visit us at www.cleantechnologies.dupont.com and schedule a PeGASyS™ test today.

1994
Started up the first major metallurgical smelter off gas acid plant guaranteed to emit no more than 100 ppmv SO₂.

2003
Introduced XLP ribbed rings for increased activity and lower pressure drop



2011
Introduced GEAR™ catalyst for further reduced pressure drop and even greater levels of catalyst activity.

2019
Introduced XLP-310 and Super GEAR™, providing plants with high performance options.



2020
Another MECS® catalyst innovation will be introduced

2021
More catalyst innovations to come



DuPont Clean Technologies

The Clean Technologies division of DuPont is a global leader in process technology licensing & engineering, offering critical process equipment, products and services that enable an array of industrial markets, including phosphate fertilizer, non-ferrous metals, oil refining, petrochemicals and chemicals, to minimize their environmental impact. We provide extensive global expertise across our portfolio of offerings in key applications – MECS[®] sulfuric acid production, STRATCO[®] alkylation, BELCO[®] wet scrubbing, and IsoTherming[®] hydroprocessing. We are dedicated to helping our customers produce high-quality products used in everyday life in the safest, most environmentally-sound way possible, with a vision to make the world a better place by creating clean alternatives to traditional industrial processes.

We make everyday life better, safer, cleaner.



Features and benefits of MECS[®] Super GEAR[™]

Lower SO₂ emissions and increased acid production

- 50 to 60% higher volume-based activity than conventional catalyst
- Advanced formulation and shape offers higher conversion and/or greater plant capacity

Reduce costs

- Allows for converter size to be minimized on new plant builds
- Can be selectively installed in passes two or three, where maximum benefit is obtained
- No heat exchanger modifications required

Lower life cycle costs

- Improved dust handling
- Longer time between turnarounds
- Reduced main compressor power requirement
- Low screening losses demonstrated in field trial

Proven performance

- Same shape as the commercially proven GEAR-310
- GEAR[™] catalyst continuously in service since 2011
- Demonstrated performance in the field

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MECS[®] catalyst