Elessent™
MECS® TECHNOLOGIES

SUPER GEAR™ CATALYST

THE NEXT-GENERATION MECS® HEXA-LOBED CATALYST

Elessent Clean Technologies' commitment to sulfuric acid research and innovation has resulted in a high-performance MECS® catalyst that produces lower SO_2 emissions with increased production rates while providing energy savings and longer production cycles.

Elessent Clean Technologies
MECS® Technologies
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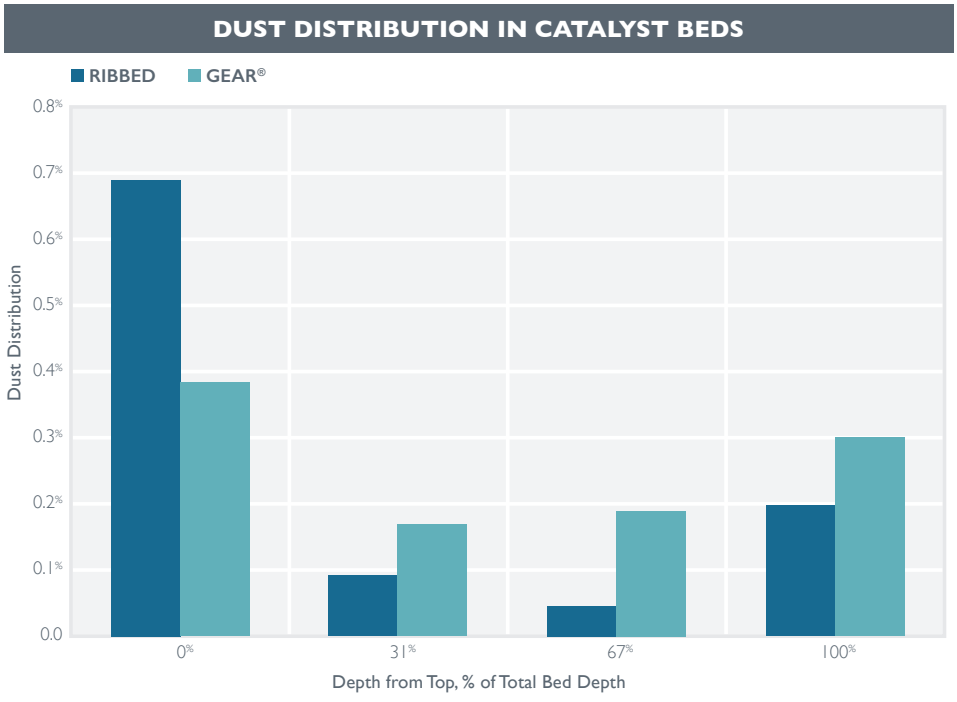
A BREAKTHROUGH TECHNOLOGY

MECS® (now Elessent 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 that maximize effectiveness. When compared to a generic ribbed ring catalyst, GEAR® cataylst 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.

SHAPE OPTIMIZATION OF GEAR® CATALYST

When developing GEAR® catalyst, and ultimately Super GEAR™ catalyst, 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 SO_2, as it diffuses and subsequently reacts in a ribbed ring and GEAR® catalyst, shows the improved rate of reaction of SO_2 within the GEAR® catalyst. As can be seen, SO_2 concentration is higher at the surface of the GEAR® catalyst, demonstrating an increased rate of migration of SO_2 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, the Super GEAR® catalyst emerges.

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



TIMELINE: MECS® CATALYST INNOVATIONS

1925
Manufacture of first sulfuric acid catalyst

1930
Complete plant design, engineering and construction of sulfuric acid plants began

1963
Introduced a new larger pellet, T-type, for lower pressure drop

1970
Built the first interpass absorption plant in the USA

1978
Designed the first stainless steel converter for high SO_2 concentrated gas

1980
LP rings introduced for reduced pressure drops up to 50%

1989
Introduced cesium promoted catalyst to allow increased capacity and lower SO_2 emissions

1994
Started up the first major metallurgical smelter off-gas acid plant guaranteed to emit no more than 100 ppmv SO_2

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™ catalyst, providing plants with high-performance options

2020
Another MECS® catalyst innovation introduced

2022 and beyond
More catalyst innovations to come

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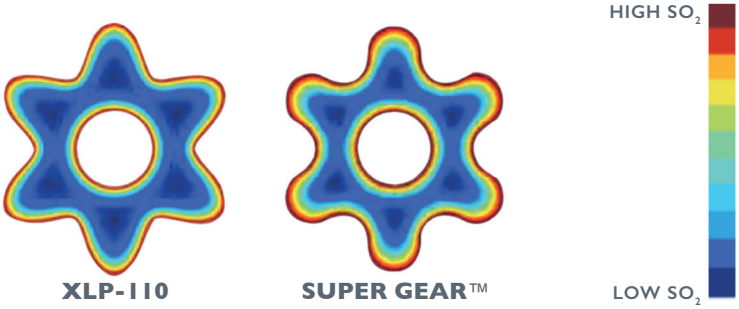
Figure 2: Ribbed ring and hexa-lobe ring catalyst cross sections at 475˚C and 11.0% SO_2

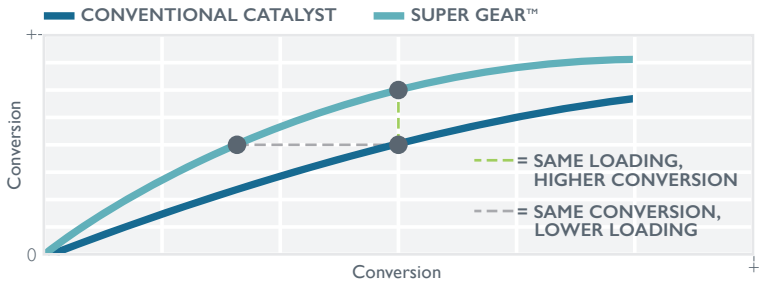


WHAT MAKES MECS® SUPER GEAR™ CATALYST SO SUPER

Highest activity

The advanced formulation of Super GEAR™ catalyst and its 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™ catalyst and conventional catalyst



Increased capacity, reduced emissions and capital cost

MECS® Super GEAR™ catalyst 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™ catalyst lowers emissions, increases capacity

	Base case	Partial replacement in pass 3	Complete replacement in pass 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

The catalyst Research and Development team at MECS® has introduced many catalyst innovations to the sulfuric acid industry over the past 90+ years and as a result today is 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™ catalyst will address emissions and 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 representative, or visit us at MECS.ElessentCT.com to schedule a PeGASyS™ test today.

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ELESSENT CLEAN TECHNOLOGIES

Elessent Clean Technologies is a global leader in process technology licensing and 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 and cleaner.

FEATURES AND BENEFITS OF MECS® SUPER GEAR™ CATALYST

Lower SO_2 emissions and increased acid production

- 50% to 60% higher volume-based activity than conventional catalyst
- Advanced formulation and shape offer 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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