

The Global Leader in Catalysis

Business Overview for the
Catalysts Division

 **BASF**

We create chemistry



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BASF's Catalysts division, headquartered in Iselin, New Jersey, is a global division of BASF SE, Ludwigshafen, Germany. BASF Catalysts is the world's leading supplier of environmental and process catalysts, and we create chemistry for a sustainable future. We offer exceptional expertise in the development of technologies that protect the air we breathe, produce the fuels and battery materials that power our world and ensure efficient production of a wide variety of chemicals, plastics and other products. By leveraging our industry-leading research and development (R&D) platforms and passion for innovation, we develop unique, proprietary solutions that drive customer success.



Strong R&D Platform

- Global R&D presence
- Focus on alignment of regional capabilities to local market needs
- ~1,100 catalyst experts globally
- Supported by ~10,000 scientists in BASF Research Verbund



Driving Innovation Through Research and Technology

Our extensive experience has led us to gain the broadest knowledge base in the industry. Product innovation is driven by our significant and ongoing investment in R&D. This competitive strength allows BASF to bring customers the most effective and efficient solutions.

Our Customers' Success

BASF helps our customers to be more successful through our experience, technological expertise, market know-how, and innovative strength in chemistry. We combine economic success with environmental protection and social responsibility. Through research and innovation, we support our customers in nearly every industry in meeting the current and future needs of society. We have summed up this contribution in our corporate purpose: **We create chemistry for a sustainable future.**

Comprehensive Portfolio of Products and Services

Our catalyst solutions

The value of the catalyst solution is measured by more than just its price. At BASF, we understand that it must include commercial and technical support, global supply, and responsive customer service. That's why we've built a commercial and technical group that collectively has unparalleled experience in the development and application of catalyst technologies across the entire range of catalytic processes. This expertise is further strengthened by a global team of customer service providers, a strong R&D presence, more than 30 centers of manufacturing excellence, and the capability of BASF's global supply chain.



Adsorbents

Proprietary alumina, silica, alumino-silica gels, bentonite adsorbents and a broad line of base metal oxide guard bed materials for refining, petrochemical, chemical, and gas processing industries



Aircraft Cabin/Fuel Inerting

Catalyst technology that reduces both harmful ozone and Volatile Organic Compounds (VOC) in aircraft cabin air



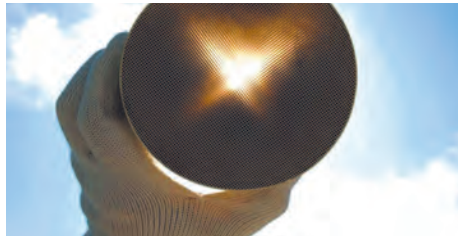
Battery Materials

Broad battery materials portfolio of advanced cathode active materials for lithium-ion batteries such as Nickel Cobalt Aluminum (NCA) oxide and Nickel Cobalt Manganese (NCM) oxide



Indoor Air Quality

Emission-control catalyst technologies for the abatement of carbon monoxide, VOC, nitrogen oxides, ammonia, particulate, ozone, and more to protect the air we breathe



Mobile Emissions Catalysts

Emission-control catalysts for light-duty and heavy-duty vehicles, motorcycles and utility engines



Precious & Base Metals Services

Precious metal products and services including procurement, trading, sales and refining as well as salts and solutions preparation



Process Catalysts

Chemical Catalysts such as hydrogenation catalysts, dehydrogenation catalysts and oxidation catalysts, Custom Catalysts and Fluid Catalytic Cracking (FCC) refinery catalysts – to name a few



Stationary Source Emissions

Solutions include CO (carbon monoxide) oxidation catalysts to remove CO, VOC (Volatile Organic Compounds) oxidation catalysts to remove VOC, SCR (Selective Catalytic Reduction) catalysts to remove NO_x (nitrogen oxides) and ammonia destruction catalysts to remove ammonia



Temperature Sensing

High-quality temperature sensing products and calibration services that leverage our historical precious metal expertise, and our unique, highly advanced optics, electronics and software

Mobile Emissions Catalysts

Our mobile emissions catalysts are designed to protect the air we breathe by removing impurities, such as hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM).

A Global Leader in Mobile Emissions Catalysts



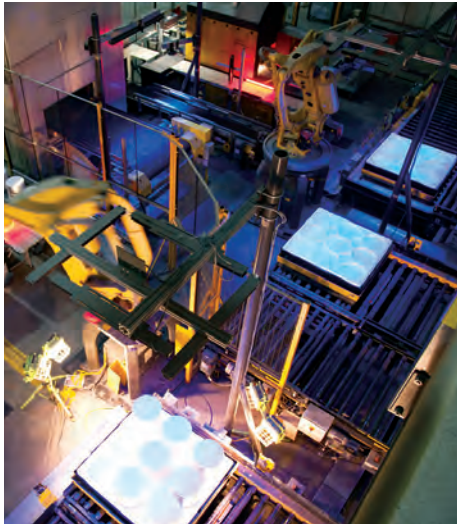
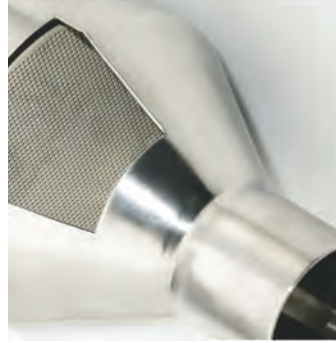
We create catalysts for:

- Light-duty vehicles (gasoline and diesel)
- Heavy-duty vehicles (on- and off-road)
- Motorcycles, utility engines, and more
- Alternative fuel vehicles including natural gas vehicles



Principal Products

- Three-Way Conversion Catalysts (TWC)
- Four-Way Conversion Catalysts (FWC™)
- Diesel Oxidation Catalysts (DOC)
- Catalyzed Soot Filters (CSF)
- Selective Catalytic Reduction (SCR)
- SCR on Filter (SCRoF)
- Ammonia Oxidation Catalysts (AMOX)
- Lean NOx Traps (LNT)
- Multifunctional Catalyzed Soot Filter (CSF.4)
- Natural Gas Catalysts (NGC)
- Ozone Decomposition Catalysts (PremAir®)
- Air Intake Hydrocarbon Trap (EvapTrap™)

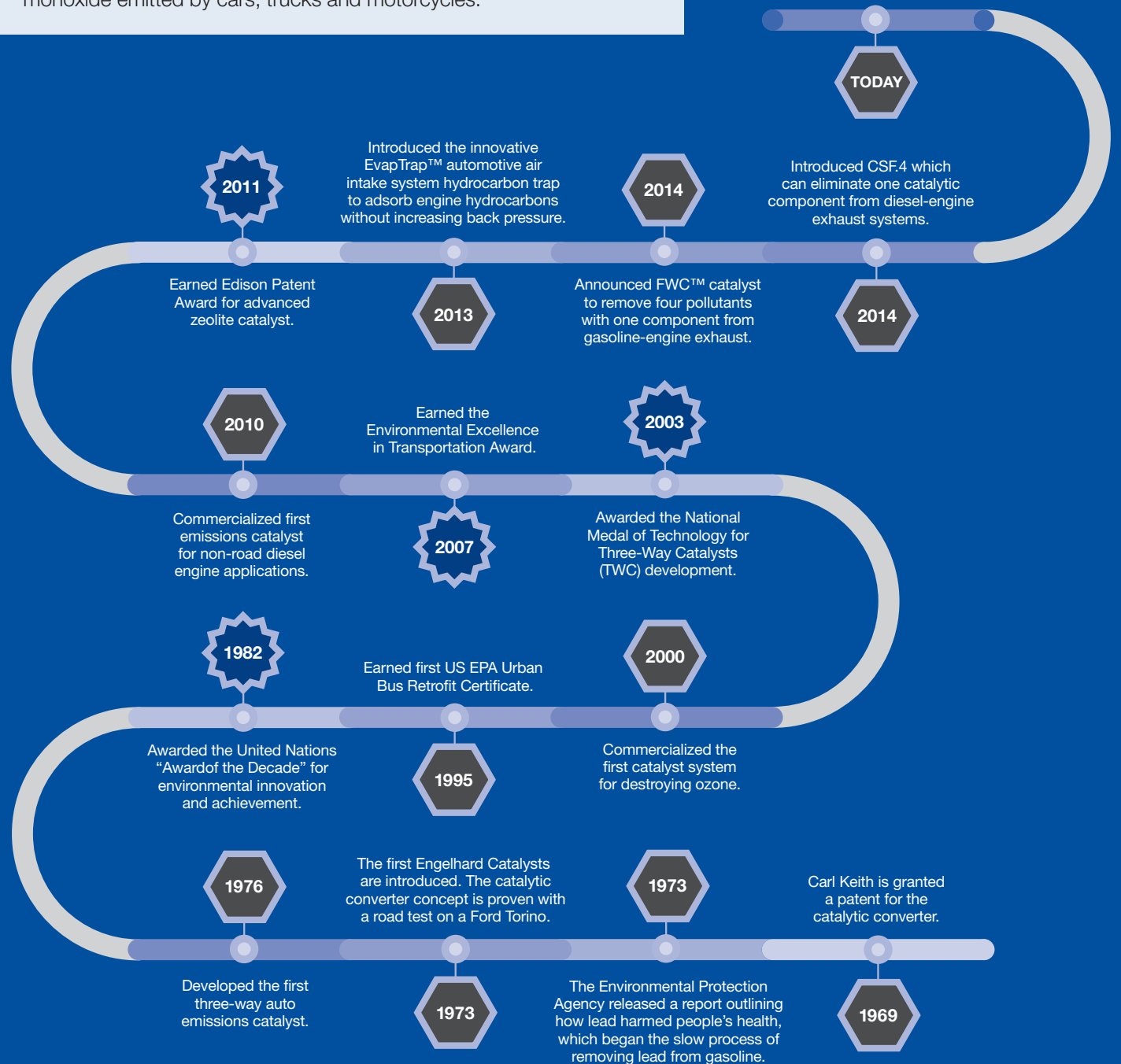


The Four-Way Conversion catalyst (FWC™) not only converts carbon monoxide, non-combusted hydrocarbons and nitrogen oxides into water, nitrogen and carbon dioxide, but also removes harmful particulate matter from the engine exhaust in gasoline-powered vehicles.

The Inventor of the Catalytic Converter

The Environmental Protection Agency (EPA) estimates that the introduction of catalysts, and other improvements in air quality saved more than 100,000 lives, and led to a 40 percent reduction of carbon monoxide emitted by cars, trucks and motorcycles.

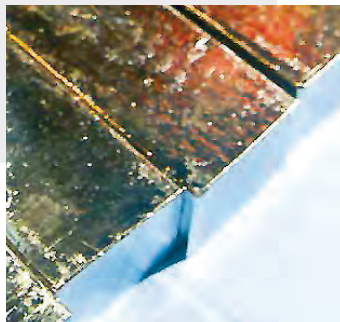
Today: We are working on even more advanced technologies for emission control to help vehicle manufacturers meet the most stringent legislation for vehicle emissions.





Precious & Base Metals Services

For 150 years, BASF has been a worldwide leader in the field of precious metals management and a full service provider of precious metals products and services.



Full-service Provider

BASF is a full-service provider of precious metals products and services. We leverage our unparalleled market insight and decades of precious metals sourcing, trading and hedging expertise to create a tangible competitive advantage for BASF and our industrial customers. We tailor our programs to meet our customers' specific precious metals needs and requirements.

BASF is a worldwide leader in the field of precious metals management, and offers industrial customers a "full loop" of metals management services. From raw metals supply and scrap reclamation to financial risk management, BASF professionals provide confidential, value enhancing solutions to our industrial clients.

Our hallmark and assay certificate is recognized globally as "Good Delivery" in all relevant precious metals markets. The EIB (Engelhard Industrial Bullion) prices are published daily. BASF is a founding member of the London Platinum and Palladium Market (LPPM).



Commercial Trading Services

Backed by Platinum Group Metals (PGMs) and Catalysis expertise, BASF can assist you to manage and handle precious metals for your catalyst requirements. Our team will help enable cost-efficient PGM management for the entire lifecycle of your catalyst. Leveraging a worldwide network of resources, BASF provides 24-hour trading presence and access to global precious metals markets. We facilitate security of supply and help reduce customer risk exposure to volatile PGM markets by drawing on BASF's wide proficiency in the catalyst industry.

Further, our team prides itself on transparency and close collaboration to structure a complete solution for our customers' precious metal needs.

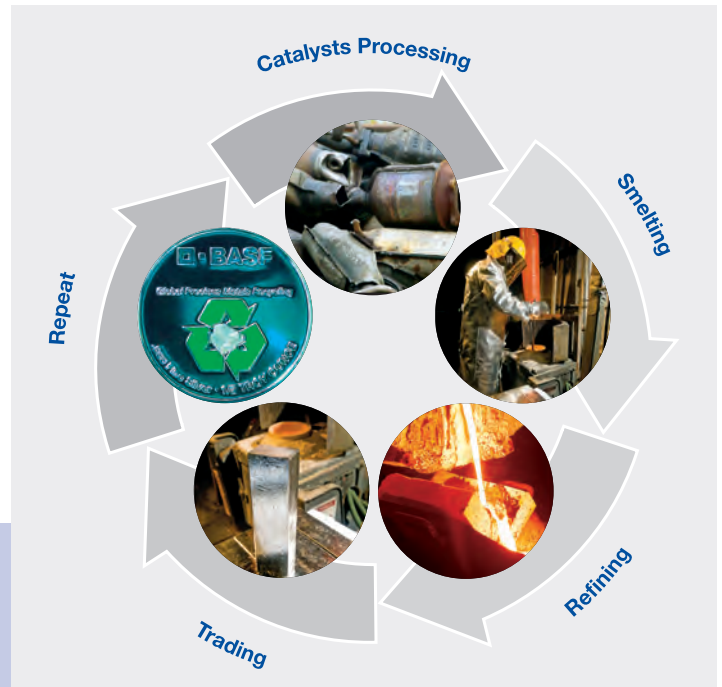


PGM Recycling Services

We recycle precious metals from spent automotive catalytic converters, diesel catalytic converters, and chemical catalysts.

BASF supplies best-in-class recovery rates of PGMs from precious metal bearing waste materials. We understand that today's market is volatile due to a variety of geopolitical, environmental, and regulatory factors.

Look to us to support you while you manage your precious metals business and reduce your exposure to metal shortages and fluctuations.



From recycling to trading, you can trust the expertise of BASF products and services



PGM Salts, Solutions and Activated Powders

BASF offers a robust portfolio of PGM chemical intermediates for use in a variety of industrial catalysis applications. Our innovative PGM Salts, Solutions and Activated Powder products are manufactured at our ISO 9001 certified manufacturing facilities located in Seneca, South Carolina, U.S.; Rome, Italy; Shanghai, China.

Process Catalysts

Chemical reactions require catalysts. As the global leader in catalysis, BASF acts through continuous product and process innovations in collaborative partnerships with our customers. The result is a broad catalyst portfolio backed by dedicated customer and technical service and enabled through the strength of BASF.





Chemical Catalysts & Adsorbent Solutions

BASF offers catalyst solutions along the chemical synthesis value chain as well as adsorbents for a broad range of fuel and air-purification applications in the chemical, gas processing, petrochemical and refining industries.

New Technologies

BASF targets a joint approach for the development and commercialization of new process and associated catalysts. Bringing our own ideas and creativity, we primarily focus on the development of the catalysts while our process engineering partner remains focused on the process aspects.



Refining Catalysts

BASF delivers innovation, value and performance to refineries. Our portfolio of Fluid Catalytic Cracking (FCC) catalysts, additives, and co-catalysts is supplemented by expert technical support and services.

Custom Catalysts

A custom catalyst is a catalyst developed or co-developed by a BASF customer. As the global leader in catalysis, BASF offers a broad range of manufacturing assets combined with expertise critical to the success of custom catalyst development. Collaborating with our customers allows them to develop and commercialize their catalyst technology. From idea creation through to scale-up and manufacturing, BASF provides the entire value chain. Our proven business model is based on our more than 50 years of custom catalyst manufacturing.



Battery Materials

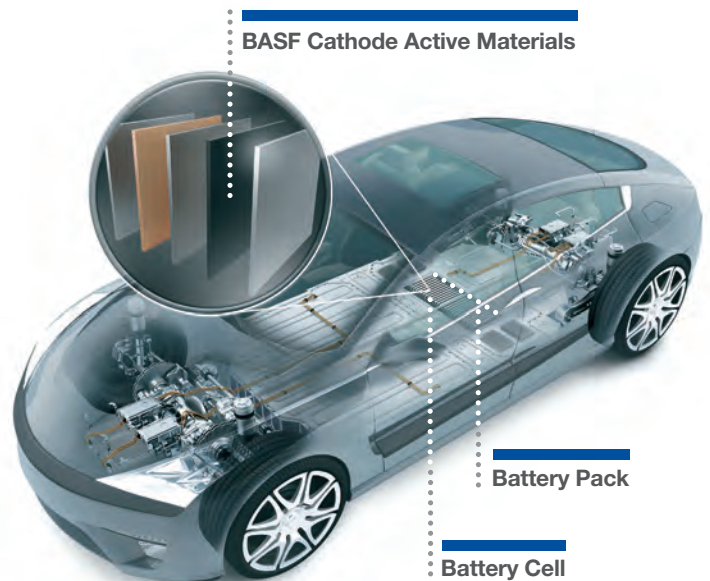
BASF's broad battery materials portfolio includes advanced cathode active materials for lithium-ion batteries such as Nickel Cobalt Aluminum (NCA) oxide and Nickel Cobalt Manganese (NCM) oxide, which play a key role in determining battery performance, energy density, service life and safety. Our global research set-up and business presence enable us to provide a broad expertise and increased customer proximity to support our customers to develop leading technologies and achieve the success in the rapidly growing global electric vehicle market.

Cathode Active Materials

Our HED™ product family is a high energy density cathode active material for lithium-ion batteries. Due to a very high degree of purity, excellent product characteristics and proven abilities to develop jointly with customers, our products will support for the evolving requirements of batteries in automotive drivetrains.

- HED™ Nickel Cobalt Aluminum (NCA)
- HED™ Nickel Cobalt Manganese Oxide (NCM)

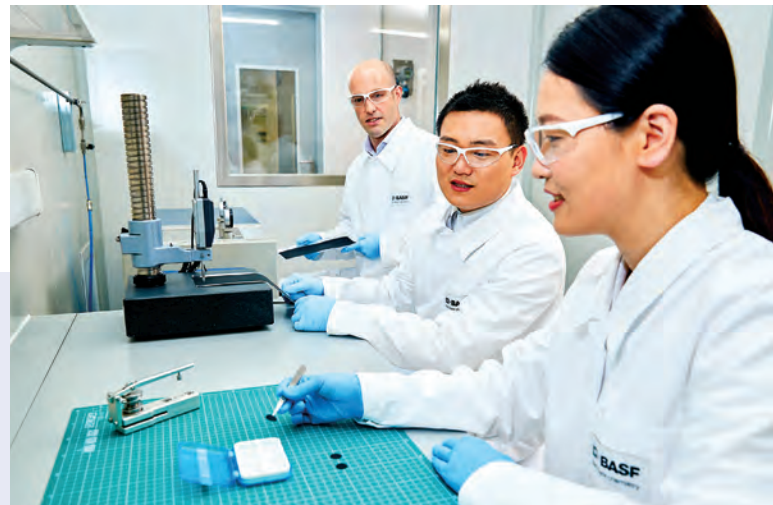
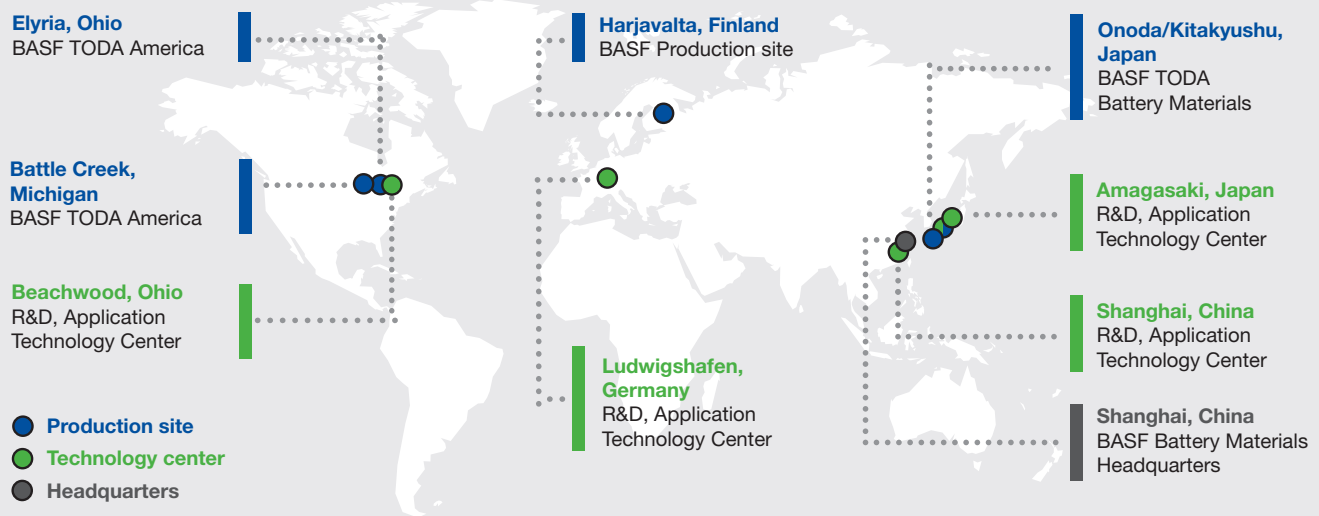
BASF also has a worldwide license to produce and market lithium-ion battery materials from Argonne National laboratories (ANL)—the global leader in Nickel Cobalt Manganese (NCM) technology.



BASF is a leading supplier of high energy density cathode active materials to the automotive industry.

Global Presence

BASF is a strong player in the battery materials market and runs pilot and production plants in all major regions: Ludwigshafen, Germany; Elyria and Beachwood, Ohio, U.S.; Battle Creek, Michigan, U.S.; Onoda and Kitakyushu, Japan; and the new announced production site in Harjavalta, Finland.



- Largest chemical supplier to automotive industry, unparalleled customer access and market knowledge
- Strong technology and intellectual property position in cathode active materials
- One of the broadest cathode active materials portfolios in the industry. Market leader in nickel-rich cathode active materials
- Strong market presence with operations in all regions. R&D sites and expert scientists around the world located close to our customers
- Decades of collaboration with various strategic partners including customers and academia
- Commitment to sustainable development and a responsible global supply chain

Driving New Business Opportunities

BASF's Catalysts division is committed to expanding its technologies and markets beyond those we currently serve, creating new business platforms to drive future sustainable growth. We are targeting these strategic growth platforms in particular:



Clean Air Solutions

Building on our extensive technology expertise in emissions control, we are expanding our capabilities to provide solutions to enable clean air for a sustainable future.

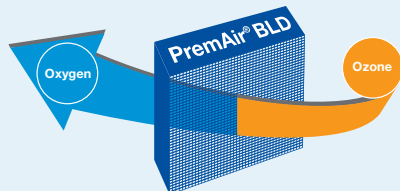
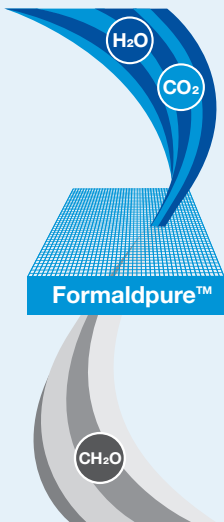


Aircraft Cabin

BASF's Deoxo™ converters reduce both harmful ozone and Volatile Organic Compounds (VOC) in aircraft cabin air to maintain a healthy cabin environment. BASF Maintenance, Repair and Overhaul (MRO) Service has the original aircraft manufacturers engineering-OEM CMM (Component Maintenance Manual) for Deoxo™ converters.

Indoor Air Quality

Understanding and controlling common pollutants indoors can help reduce risk of indoor health concerns. BASF's Formaldpure™ catalyst removes formaldehyde and the PremAir® BLD catalyst removes ozone to improve indoor air quality.



Industrial Emissions

Thousands of our catalysts are in use around the world, helping industrial leaders in power generation, process industries and other applications, reduce pollutants.





We create chemistry for a sustainable future.

Sustainability at the Core

One way BASF contributes is by providing innovative solutions that help its customers make their products more sustainable. By reconciling profitability with social responsibility and environmental protection, we are unlocking sustainable benefits for our customers and for BASF. Our solutions are enabling high performance and continuous operational improvements while minimizing environmental impact.

At BASF, we combine applications engineering expertise with innovative design and chemistry. This creates a more sustainable operation and environment for our customers and along the value chain.



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RESPONSIBLE CARE[®]
OUR COMMITMENT TO SUSTAINABILITY

BASF supports the worldwide Responsible Care[®] initiative of the chemical industry.

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