

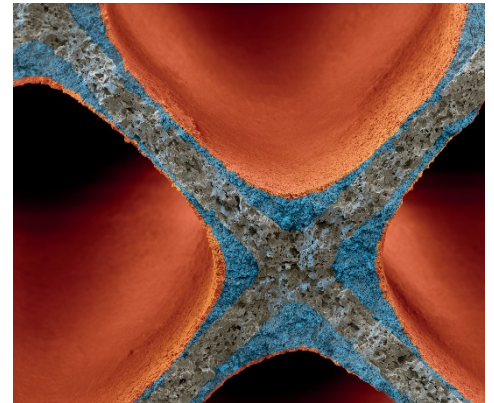
# Mobile Emissions Control Catalysts

## TWC Three-way catalysts

BASF has unsurpassed expertise in the development of catalysts for a wide range of applications that protect the air we breathe. Catalyst expertise enabled us to pioneer the development of the first catalytic converters for automobiles, which has been in used in North America since 1975. A year later, BASF introduced Three-Way Conversion catalyst (TWC), which today is capable of destroying over 90% of Hydrocarbons (HC), Carbon Monoxide (CO) and Nitrogen Oxides (NOx) produced by gasoline engines.

This state-of-the-art platform technology uses BASF's patented, segregated washcoat technology, which precisely places the precious metals within the washcoat, resulting in several important benefits:

- Optimal use of precious metals
- Lower cost and higher effectiveness
- Higher conversions of CO, HC and NOx over a wide range of conditions



Detailed view of a three-way conversion catalyst: the palladium layer (blue) selectively oxidizes hydrocarbons and carbon monoxide to carbon dioxide and water, while the rhodium layer (red) simultaneously converts nitrogen oxides to nitrogen, carbon dioxide and water with the aid of carbon monoxide or hydrogen, the ceramic substrate (grey).

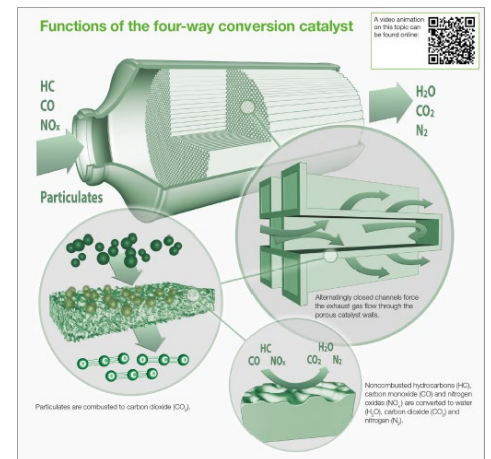
## FWC™ Four-way catalysts

The innovative single component FWC™ (Four-Way Conversion) catalyst can remove Particulate Matter (PM), as well as Carbon Monoxide (CO), Hydrocarbons (HC) and Nitrogen Oxides (NOx) from gasoline engine exhaust. Upcoming Euro 6, US Tier 3 and China Stage 6 regulations will enforce, besides the well-known limits for HC, CO and NOx, tighter control of PM emissions from gasoline engine powered vehicles.

The innovative FWC™ catalyst combines the functionality of a TWC catalyst with a filter to remove all four pollutants with just one component. The benefits include:

- **Reduce emissions** - Precious metal-containing catalytic converter on ceramic substrate cleans car engine exhaust gases.
- **Remove particulates** - Compact catalytic converter system with integrated particulate filter.
- **Comply with limits** - Ensure particulate emission below tight regulation limits.
- **High effectiveness** - Smart solutions to lower backpressure impact to engine and fuel.

BASF's catalytic converter can filter 99% of pollutants from car exhaust gases



The four-way conversion catalyst consists of a ceramic support coated with precious metals.

**5.8**

billion euros was the value of the global catalytic converter market for vehicles in 2015, compared to 4.2 billion euros in 2012

**84**

million vehicles (excluding trucks) were produced worldwide in 2013; in 2020, the figure is likely to be 113 million

**4.5**

milligrams of particulates per kilometer is the allowed emission level for diesel or gasoline engine powered automobiles with direct injection (Euro 6c standard)

## About Us

BASF's Catalysts division is the world's leading supplier of environmental and process catalysts. The group offers exceptional expertise in the development of technologies that protect the air we breathe, produce the fuels that power our world and ensure efficient production of a wide variety of chemicals, plastics and other products, including advanced battery materials. By leveraging our industry-leading R&D platforms, passion for innovation and deep knowledge of precious and base metals, BASF's Catalysts division develops unique, proprietary solutions that drive customer success.

**BASF - We create chemistry**

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