

## Continual improvement of the automotive catalytic converter

Feature Company: BASF Catalysts

**Summary:** Since the invention of the automotive catalytic converter in 1976, platinum group metals have played an integral role in the reduction of air pollution from vehicle exhaust. As emissions control standards around the world continue to increase, BASF Catalysts is at the forefront of developing innovative solutions to increase the effectiveness of this critical technology.

Today, modern cars emit up to 99% less exhaust pollutants than 30 years ago thanks to platinum group metals (PGMs) and their integral role in catalytic converters.

First offered in 1976 by Engelhard Corporation (now owned by IPA member, BASF Catalysts), the three-way catalytic converter works to reduce the emission of the most dangerous pollutants found in vehicle exhaust. These hazardous pollutants – hydrocarbons, carbon monoxide and compounds of nitrogen and oxygen – contribute to environmental and human health problems such as acid rain, and an increase in smog and breathing difficulties.

Platinum group metals are an integral part of the catalyst. They help trigger the chemical reactions in the catalytic converters that turn hydrocarbons, carbon monoxide and oxides of nitrogen into considerably less harmful compounds such as carbon dioxide, nitrogen and water vapour.

The widespread introduction of such catalytic converter systems in North America (starting in 1976) and Europe (1986) resulted in a marked decrease in metropolitan air pollution from harmful tailpipe emissions despite a growing population of vehicles. These achievements resulted in the Engelhard Corporation being awarded the United Nations “Award of the Decade” for environmental innovation and achievement (1982), Finland’s Walter Ahlström Prize for “significant technological achievement” in development of catalytic converter (2001), and the United States’ National Medal of Technology for the three-way catalyst (2003).



Platinum, palladium and rhodium are all used in catalytic converters, which are standard equipment in more than 80 percent of new cars today.

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Catalytic converters are standard equipment in more than 80 percent of new cars today. With a degree of efficiency of up to 99 percent, they demonstrate a high level of technical achievement. But emissions standards are becoming more strict the world over. The “Euro 5 standard”, for example, which is intended to further reduce nitrogen oxides and hydrocarbon emissions, came into effect in Europe in September 2009. The even stricter “Euro 6 standard” will come into effect in 2014. Researchers at BASF must therefore continually research and design more effective and efficient catalytic converters for automobiles.

The biggest challenge for exhaust gas experts is actually reducing tailpipe emissions from diesel powered vehicles. Their lower fuel consumption is good news for the wallet, and also helps preserve the earth’s crude oil resources; however, diesel engines can emit a large amount of carbon particulates (i.e. soot) and nitrogen oxides. Moreover, the excess oxygen in the exhaust of diesel engines prevents the use of traditional three-way catalysts.

To overcome these challenges, BASF researchers have developed special diesel oxidation catalysts combined with particulate filters which trap the soot and periodically oxidise it using a combination of catalysts and engine controls. In fact, working together, catalytic converters and particulate traps can further reduce the mass of particulate emissions by 90%. This combination of diesel oxidation catalyst and catalyzed soot filter is also very effective for the removal of carbon monoxide and hydrocarbon from the exhaust.

As emissions control standards around the world continue to increase, so too will the demand for innovative solutions. The invention and continuous improvement of the catalytic converter demonstrates how PGMs continue to play an integral role in the design and development of more sustainable vehicles.



Thanks to the three-way catalytic converter, the EU has seen a dramatic drop in emissions of the various pollutants found in exhaust fumes.

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