PLATINUM GROUP METALS IN AUTOCATALYSTS

The use of Platinum Group Metals platinum, palladium and rhodium in autocatalysts is key to reducing harmful vehicle emissions

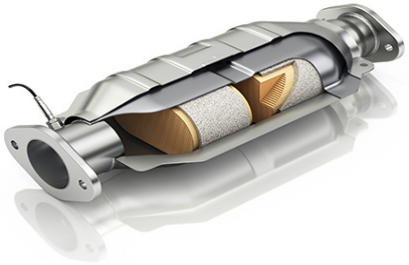
Often derived from the same ore, platinum, palladium and rhodium are three of the Platinum Group Metals (PGMs), a family of six elements that are chemically, physically and anatomically similar.

PGMs are highly valued and used in many industrial applications as their physical and catalytic properties are suited to the manufacture of, or use in, items such as automotive components, electronics, fertiliser, glass and medical devices. In the automotive sector, platinum, palladium and rhodium are key components in autocatalysts which reduce harmful emissions from vehicles and improve air quality.

An autocatalyst reduces harmful emissions from internal combustion engine vehicles by converting exhaust pollutants, including carbon monoxide, hydrocarbons and oxides of nitrogen, into products that occur in the atmosphere – carbon dioxide, water and nitrogen. Also called 'catalytic converters', autocatalysts are made using a metal or ceramic layer that is coated with PGM-containing material (or washcoat) and canned in a metal housing. The PGMs in the autocatalyst cause the exhaust combustion gases to react, without the metals themselves being changed or 'used up' in the process.

The first-ever autocatalysts were fitted to vehicles in the US in 1975 as a response to poor air quality and to meet newly- introduced emissions standards. Patterns of use between platinum, palladium and rhodium in autocatalysts have varied over time, while emissions standards have grown ever more stringent. Usage is determined by multiple factors including the effectiveness, availability and price of each metal.

The catalytic efficiency of each metal is influenced by engine temperature, fuel type, fuel quality and durability of the autocatalyst's washcoat. Today, platinum is predominantly used in autocatalysts in diesel vehicles, with palladium principally in those in gasoline vehicles. However, this usage is shifting, with substitution of palladium for platinum occurring due to sustained palladium deficits and the high price of palladium, now over US$1,300/oz higher than platinum.



Cross section of a catalytic converter

PGM demand

Historically, tightening emissions legislation rather than changes in volumes of vehicle sales have driven PGM automotive demand growth. Between 1990 and 2019 annual car sales rose from c.54 m to c.92 m, while PGM use in autocatalysis rose from 2.2 moz per annum to 13.8 moz per annum.

Tightening emissions standards for oxides of nitrogen, including more stringent on-road rather than laboratory testing, continue to require more PGM per car, as does the use of low-carbon dioxide hybrid and mild-hybrid vehicles. This is because greater PGM loadings are required on these vehicles, which operate at cooler engine temperatures in their start-up phase.

The imperative for lower carbon dioxide emissions, to contribute to global climate change reduction goals, is reinforcing demand for diesel engine cars (including diesel hybrids), which have a 20 to 35 percent carbon dioxide benefit over gasoline engine cars. This, in addition to substitution, is a dominant driver for platinum demand growth.

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