PLATINUM
Old and New Uses in Old and New Markets

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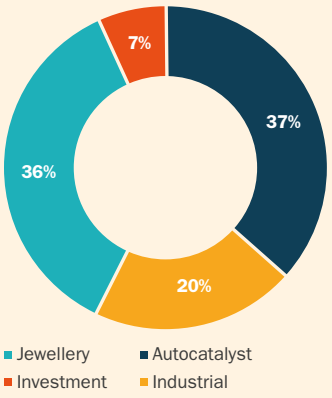
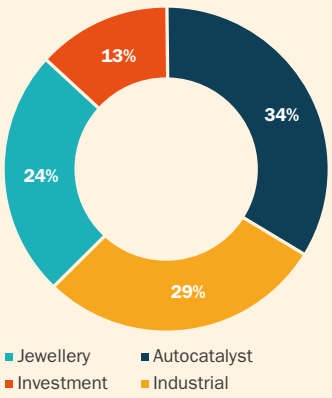
The 25th anniversary of the *Alchemist* is a significant milestone, and a chance to look back at how platinum demand has evolved over the last 25 years and how platinum might evolve over the next 25 years.

GROSS PLATINUM DEMAND IN 1995
5.0 MILLION OUNCES



GROSS PLATINUM DEMAND IN 2019
8.5 MILLION OUNCES



Source: Johnson Matthey Platinum Reviews

At first glance, it might seem that there has been only gradual change for platinum demand since the *Alchemist* was first published in 1995. Overall demand is considerably higher, at 8.5 million ounces compared to 5.0 million ounces in 1995. But gross automotive demand in 2019 was still the largest sector, as it was in 1995, and with a relatively similar share of demand. Jewellery and industrial demand are the next two, though they have swapped around in relative size.

DIG A LITTLE DEEPER, HOWEVER, AND MORE DIFFERENCES BECOME APPARENT

In those two largest sectors in 1995, autocatalyst and jewellery demand, 25 years was long enough to see multiple cycles.

The first half of this period, up to 2007, saw a rapid rise in platinum demand from European autocatalysts and Chinese jewellery.

OVERALL DEMAND IS CONSIDERABLY HIGHER AT 8.5 MILLION OUNCES COMPARED TO 5.0 MILLION OUNCES IN 1995

The second half saw both fall back. Over this latter period, industrial demand and investment demand began to take a greater share.

Starting with automotive platinum demand, this more than doubled between 2000 and 2007, reaching 50% of gross platinum demand. Tighter global emissions standards helped, but the biggest impact came from the rapid adoption of diesel passenger vehicles in the European market, which required platinum-only catalysts (due to better low-temperature performance). Platinum's then high price relative to palladium, however, led increasingly to the use of the latter metal in gasoline autocatalysts, and that, together with a falling diesel share in Europe from around 2013, saw platinum automotive demand fall back (partly cushioned by an increase in heavy-duty diesel platinum automotive demand).

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20%

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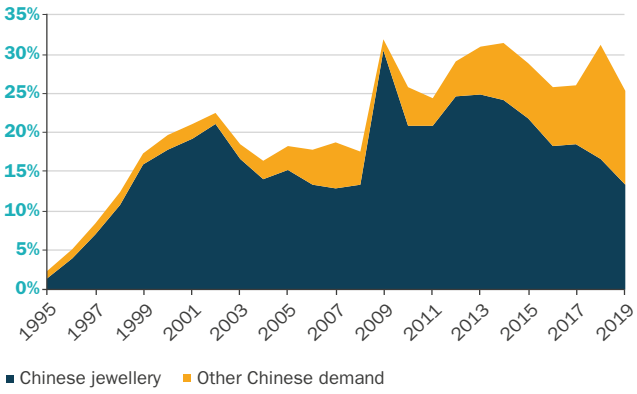
CHANGES IN DEMAND

Chinese platinum jewellery demand, aided by the market development work of the Platinum Guild International (PGI), saw astonishing growth around the turn of the millennium, taking it from almost nothing in 1995 to 20% of all global platinum demand by 2000. Unsurprisingly during this period, it was well covered in the *Alchemist*, such as in 2000, by Susanne Capano of LBMA, who highlighted this in *Alchemist 20,* July 2000, *"The Platinum Age"* and ten years later, when it had reached 2 million ounces a year, by my colleague David Jollie, then at Johnson

Matthey (see *Alchemist 58,* April 2010*, 'The Chinese Platinum Jewellery Market'*). More recently, while remaining a very large demand sector, volumes have fallen, especially if one considers recycling.

The fall in Chinese jewellery demand has not, however, had much of an impact on China's overall share of platinum demand, which in recent years has been as high as ever. This reflects a surge in 'industrial' demand.

CHINA'S SHARE OF GROSS WORLD PLATINUM DEMAND

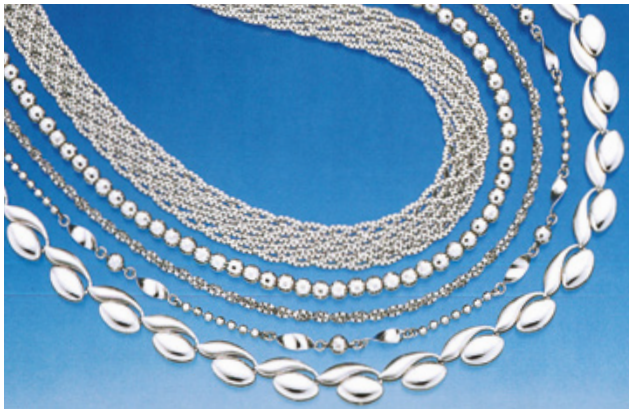


Source: Johnson Matthey Platinum Reviews

OLD AND THE NEW

The industrial sector, or more accurately sectors, reflect a success story for platinum in the second half of the last 25 years. In 1995, gross global platinum industrial demand was around 1 million ounces, 20% of total gross demand and little changed in size compared to the mid-1970s. By 2018, it had reached a record 2.7 million ounces, 30% of total demand and larger in that year than gross jewellery demand and only slightly smaller than automotive demand. 2019 was similar.

This growth has been a mixture of the old and the new. First, platinum's long-established uses, such as in petroleum refining or nitric acid, benefitted from the huge expansion of industrial capacity seen over these years, particularly in China (where 60% of the increased platinum demand arose). Second, those traditional uses expanded into new sectors, most obviously the huge rise of platinum demand for LCD and LED glass. Third, there were also new industrial applications, both stimulated by the mining sector and growing organically, such as magnetic hard discs, a key growth sector in the early part of this period, and a range of sensors and medical devices later.



"Platinum chain styles becoming very popular in China" Alchemist 20, July 2000.

FOR INDUSTRIAL PLATINUM DEMAND, ONE OF THE MOST IMPORTANT TRENDS OVER THE NEXT DECADE WILL BE FOR **A GREENER, MORE SUSTAINABLE AND RICHER WORLD.**

GROWTH OF PLATINUM ETFs

Finally, another success story in the last 25 years – indeed, arguably a new demand category – has been platinum investment. Of course, it is not brand new – platinum, in the form of bars and coins, has attracted investors for decades (as well as speculators, on futures markets in New York and Tokyo). In 1995, it accounted for 7% of demand. However, until recently, volumes were often erratic, often reflecting government coin issues. It was the launch of platinum exchange traded funds (ETFs) from the mid-2000s that galvanised the sector and, since then, demand has averaged nearly 0.5 million ounces a year, compared to less than 150,000 ounces before. In 2019, ETFs accounted for 13% of gross platinum demand.

PLATINUM'S LONG-ESTABLISHED USES, SUCH AS IN PETROLEUM REFINING OR NITRIC ACID, BENEFITTED FROM THE HUGE EXPANSION OF INDUSTRIAL CAPACITY SEEN OVER THESE YEARS, PARTICULARLY IN CHINA.

The formation of the World Platinum Investment Council to provide market and product development in this sector in 2014 underscores the growing importance of this sector to platinum's demand base.

THE NEXT 25 YEARS

What, then, might the next 25 years bring?

Our historical look suggests platinum's demand tends to evolve as a mix of expanding old uses in existing sectors, the extension of old uses in new sectors, and new uses in both existing and new sectors. This is likely to continue.

Starting with the existing uses. The safest conclusion is that those uses for platinum that have played a role for many decades – jewellery and various industrial processes – will still play a role in decades to come, albeit as they have done in the past through existing and new sectors.

Jewellery has often seen new geographical focus, from Japan, China and most recently India, where the country's strong growth and campaigns by the PGI have had success in a creating a sizeable demand in recent years.

For industrial platinum demand, one of the most important trends over the next decade will be for a greener, more sustainable and richer world. The Paris Accord's targets for CO_2 emissions cuts, and the desire of a growing number of governments and businesses to go further towards 'net-zero' carbon emissions, are being complemented by a drive for more sustainable industrial processes. Many traditional uses of PGMs will benefit from this, for example, fibreglass, which uses platinum (and rhodium) in its production process and is set to undergo strong demand growth in the 2020s due to its use in both wind turbines and the important role it plays in the light-weighting of automotive body parts. We also expect, as the middle class expands globally, an increased demand for higher-value goods that contain PGMs, such as personal electronic devices, medical applications and products made from a wide range of chemicals.

GROWTH IN BEVs AND FCEVs

Automotive demand might even see the return of the old, with platinum being used in gasoline engine catalysts for the first time since the mid-2000s. The steady tightening of emissions legislation for internal combustion engine vehicles, next to be seen in Euro 7 and China 7, will require more PGM per vehicle by the mid-2020s. Given that palladium and rhodium are already relatively highly priced with tight fundamentals, some modest substitution by platinum (and potentially of palladium for rhodium) would help balance these sectors.

More fundamental changes, both positive and negative, look to be on their way for platinum automotive demand as electrification spreads.

Most commentators see an enduring role for some time to come for the internal combustion engine – diesel and gasoline – on its own, but increasingly in hybrid, electrified vehicles where PGM loadings will be as high as they are in conventional vehicles.

INCREASINGLY IT LOOKS LIKE THERE WILL BE A ROLE FOR **FUEL-CELL ELECTRIC VEHICLES**

Battery Electric Vehicles (BEVs), which don't have PGM catalysts, are taking a growing share, but an increasing volume of overall vehicle sales means that platinum and its sister metals will see significant demand from this sector for decades yet.

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Electrification also offers new uses for platinum. Increasingly, it looks like there will be a role for fuel-cell electric vehicles (FCEVs).

These have already found use in smaller sectors such as forklift trucks and look particularly suited to the heavy-duty truck sector, where range and weight are key priorities. Development also continues in the personal vehicle space, with Toyota and Hyundai releasing well-reviewed models in the last few months, suggesting future demand here could be very substantial.

Fuel cells can also power trains, boats, stationary storage and other vehicles. At Anglo American Platinum, we're investing in developing the world's largest fuel cell mine haul truck. We expect trials to start this year at our Mogalakwena mine.

For platinum, this is a new use with great potential. Platinum loadings in fuel cells have fallen since 2006, when Wolfgang Wrzesniok-Rossbach, then at Heraeus, noted that a 40kw stack required four ounces of platinum (see *Alchemist 41,* January 2006, *'$1,000 for 31 Grams of Platinum'*).

Today, we think that would be less than half an ounce and, by the end of decade, a much more powerful 100kw stack might require little more than a third of an ounce. But this loading of metal would still be twice that of a current diesel vehicle, yet only a small part of the overall cost of such a vehicle.

RENEWABLE ENERGY

Related to fuel cells, but distinct, is the wider potential for hydrogen in helping meet the demands of 'net zero'.

The breakthrough technology here has been the availability of cheap and plentiful renewable energy, such as solar or wind, which allows the production of 'green' hydrogen made through electrolysis from water. This can, and will, help to enable fuel cell adoption, but it also means hydrogen can help decarbonise otherwise difficult to decarbonise sectors. For example, it can be burned for heating or cooking, or to replace coal in blast furnaces. PEM electrolysis, the preferred route to generate 'green' hydrogen from renewable energy, uses an iridium/platinum catalyst.

THE AVAILABILITY OF CHEAP AND PLENTIFUL RENEWABLE ENERGY, SUCH AS SOLAR OR WIND, WHICH ALLOWS THE PRODUCTION OF 'GREEN' HYDROGEN MADE THROUGH ELECTROLYSIS FROM WATER.

Finally, we should consider whether there will be platinum-using technologies that are currently embryonic or even not yet invented. It is sobering to think that while autocatalyst demand was the largest sector for platinum demand in 1995, when the *Alchemist* was first coming off the printing presses, 25 years earlier in 1970, it did not exist.

The US Clean Air Act, which ultimately led to every US vehicle being fitted with a platinum-bearing autocatalyst, was made law only in that year. Similarly, the 1970s' largest platinum demand source (at least in the US), as a catalyst for petroleum refining, did not exist 25 years before that. What 'unknown, unknowns' will we be talking about over the next 25 years and the next 100 issues of the *Alchemist*?