

# PLATINUM

## AUTOCATALYST

Global demand for platinum in the autocatalyst market increased to a record level of 4.20 million ounces in 2006, 11 per cent more than in 2005. The main force behind this growth was the continuing success of the diesel engine in capturing market share from the gasoline engine in Europe, with platinum employed both on catalysts and on particulate filters fitted to light duty diesel vehicles. Outside Europe, rising vehicle production maintained platinum consumption on light duty vehicles at levels close to those of 2005, countering the ongoing trend to minimise platinum use in three-way catalysts by replacing it with palladium. Emissions control equipment fitted to heavy duty diesel vehicles also made a substantial contribution to metal demand in all regions.

## Europe

European vehicle manufacturers purchased 2.16 million ounces of platinum for use in autocatalysts in 2006, 10 per cent more than in 2005. The number of cars sold in Western Europe increased by 0.6 per cent to 14.6 million units and production also grew by a similar amount. Sales were boosted at the end of the year by a strong German market where consumers responded to an impending tax hike by bringing forward their purchases of new vehicles, a factor which could impact sales in 2007. Most other major national markets saw a decrease in the sales of new cars because of a decline in consumer spending.

However, the most important force behind the increase in platinum demand was the continuing rise

of the diesel engine. In 2006, diesel cars took a record 51 per cent of all European sales. The market share of the diesel engine has been growing in Europe for many years and is still rising. With auto manufacturers fitting catalysed soot filters (CSFs) as well as diesel oxidation catalysts, platinum consumption has grown further. At the same time, however, palladium has begun

Platinum Demand: Autocatalyst '000 oz		
	2005	2006
Europe	1,960	2,160
Japan	600	595
North America	820	905
Rest of the World		
China	115	155
Other	300	380
<b>Total</b>	<b>3,795</b>	<b>4,195</b>

to be introduced into some catalyst formulations, replacing some of the platinum.

With such a heavy emphasis on manufacturing diesel vehicles, the European auto companies have already largely switched to palladium, where feasible, in three-way catalysts in order to reduce costs. As a result, there was little replacement of platinum in gasoline applications.

The heavy duty diesel market also contributed to this record overall platinum demand. With the introduction of new Euro IV

rules from the start of October 2006, some of these Euro IV-compliant vehicles use platinum in their exhaust aftertreatment (largely in diesel oxidation catalysts and filter systems).

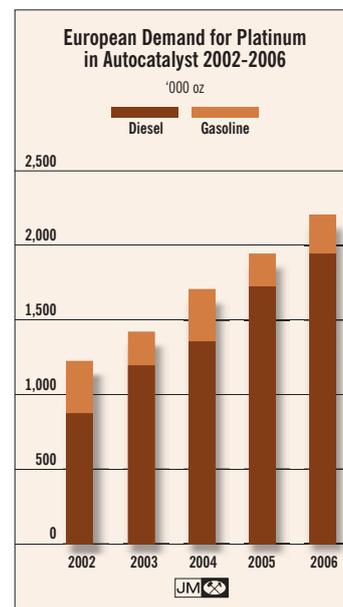
## Japan

Japanese autocatalyst demand for platinum fell by 5,000 oz to 595,000 oz in 2006, a smaller decrease than we had forecast in November. Domestic light vehicle production outperformed expectations for the final quarter, reaching an annual 11 million units.

This increase of 5.1 per cent on the previous year was mainly due to a strong export performance which outweighed relatively weak domestic sales. Most increases in capacity made by the Japanese car makers over recent years have been overseas. However, 2006 saw a rekindling of interest in expanding domestic manufacturing in the wake of strong global sales which could not be met from overseas plants. Domestic production volumes therefore rose, increasing precious metal consumption.

We have also seen the continuation of palladium replacing platinum in three-way catalysts. As previously reported, this process has been slower in Japan than elsewhere but the high prices (in Yen terms) of 2006 motivated the auto makers to accelerate this process. As a result, platinum use in gasoline vehicles fell despite the increase in vehicle production.

The light duty diesel market in Japan remained





*Chinese consumer  
purchases of platinum  
jewellery remained  
relatively healthy  
in 2006.*



*The continuing rise of the diesel vehicle pushed European platinum demand higher last year to a total of 2.16 million ounces.*

unimportant in terms of platinum demand. However, use of this metal on heavy duty diesel vehicles grew, reflecting the first full year of production after the introduction of new emissions rules during 2005.

### North America

Platinum demand grew 10 per cent in North America, reaching 905,000 oz last year, with the use of catalysts on diesel vehicles the main factor in this growth.

Car sales increased in North America in 2006. However, this growth was more than offset by falling demand for light trucks, leaving the overall market at 16.6 million units, below the previous year's 17 million. These figures indicate a trend for North American consumers to look to downsize to smaller vehicles. If this continues, because of fuel efficiency concerns, it would negatively impact pgm consumption due to the lower catalyst volumes required for smaller engines.

Although this fall in production depressed platinum use on gasoline vehicles, a more important factor was the switch from platinum-rich three-way catalysts to palladium-based ones. This occurred throughout 2006 and is expected to continue in 2007.

2006 also saw the fitment of catalysts with significant precious metal content to many medium-sized diesel vehicles for the first time. Many of these are

trucks which had previously fallen under legislation classifying them as commercial rather than passenger vehicles. This allowed them to meet less stringent emissions legislation and, although many were fitted with oxidation catalysts, these contained very little platinum. These large passenger trucks must now meet stricter passenger vehicle emissions limits and their platinum loading has increased sharply.

The heavy duty diesel market also took a significantly higher amount of platinum in 2006. In excess of 100,000 oz were used in oxidation catalysts and diesel particulate filters to meet new legislation on emissions from this type of vehicle. As 2006 was the first full year in which these rules applied, however, many purchases were delayed to avoid paying the extra capital costs of the catalytic aftertreatment.

### China

Demand for platinum from the autocatalyst sector in China rose to a record 155,000 oz in 2006. With no new emissions legislation applying last year, this expansion in demand was due solely to the continuing rapid growth in the Chinese vehicle market.

In fact, Chinese light duty vehicle production outpaced the rest of the domestic economy, soaring by 29 per cent, and boosting the usage of platinum group metals as a result. All current gasoline passenger vehicles now feature catalysts based on thrifted versions of technology developed for other regions. As these formulations are already typically palladium-rich, platinum consumption was little affected by price.

Euro III limits will be imposed across China during 2007, leading to increased loading per vehicle. Although this will provide an opportunity to switch some platinum usage for palladium, it should also lead to the fitment of catalysts on many diesel vehicles, supporting platinum consumption.

### Rest of the World

Autocatalyst demand for platinum in the Rest of the World region (excluding China) also grew in 2006, reaching 380,000 oz, an increase of 80,000 oz over 2005. This figure is lower than the forecast made in our 2006 Platinum Interim Review. The reduction relates to the average loading per vehicle in many of these disparate

markets, where thrifted versions of catalysts are more prevalent than we had previously believed.

Production increases were seen in many countries. For instance, the Korean market performed well, with vehicle production growing by a steady 4 per cent to 3.8 million units over the year, reflecting a healthy domestic economy and reasonable levels of export to Europe in particular. The Indian vehicle market also continued to see good growth (14 per cent in 2006) as did the markets of South America.

As in the Chinese market, most catalysts used are low-loaded. Although there was some replacement of platinum-based formulations by palladium-based alternatives, this was more than offset by production growth, and platinum uptake rose overall.

### Autocatalyst Recovery

High metal prices had a minor but positive impact on the recovery of spent autocatalysts last year, with an increase of 85,000 oz in the amount of platinum reclaimed to a record level of 855,000 oz. However, perhaps surprisingly to some, the sustained high prices

Platinum Demand: Autocatalyst Recovery '000 oz		
	2005	2006
Europe	(170)	(185)
Japan	(35)	(35)
North America	(505)	(575)
Rest of the World	(60)	(60)
<b>Total</b>	<b>(770)</b>	<b>(855)</b>

in the second half of the year did not boost recycling volumes any further, illustrating that most of the growth is simply due to an expansion in the collection and recycling network rather than to metal prices.

Autocatalyst reclamation in Europe was boosted by the recent European End of Life

Vehicle Directive which specifies minimum levels of recycling for scrapped vehicles. The number of catalysed diesel cars being scrapped is also increasing, leading to greater platinum recovery in this region.

In North America, high commodity prices and an increasingly effective collection system for used catalysts continued driving precious metal recovery rates higher. As a result, even though the average platinum content of catalysed vehicles fell towards the end of the 1990s, the amount of platinum recovered rose again in 2006, to a total of 575,000 oz.

Elsewhere, the average vehicle lifetime is longer and scrappage rates are lower. For instance, a growing number of used cars is exported from Japan to second

and third tier markets for use there rather than being recycled in Japan. As a result, recycling rates for domestic vehicles remain low, restricting growth in autocatalyst recovery in Japan and in the Rest of the World region.

### JEWELLERY

**Purchases of platinum by the jewellery trade fell in 2006 for the fourth year in a row. Rising and volatile metal prices had a negative impact on the platinum jewellery market, cutting demand for new metal by 18 per cent from previous year levels to 1.61 million ounces, the lowest figure for 14 years.**

While consumer demand remained strong in the major geographical markets, manufacturers and retailers were keen to reduce inventory levels for financial reasons, with the result that around a quarter of the metal fabricated into jewellery was sourced from existing stock. The Asian

markets in particular saw large amounts of recycling compared to 2005 levels. Consumers were prompted to return old jewellery by high local prices; in China many of the returned pieces were traded in for new jewellery, whereas in Japan most were simply sold.

Platinum Demand: Jewellery '000 oz		
	2005	2006
Europe	195	175
Japan	510	360
North America	275	240
Rest of the World		
China	875	760
Other	110	70
<b>Total</b>	<b>1,965</b>	<b>1,605</b>

### Europe

European demand for platinum from the jewellery sector declined by 20,000 oz in 2006, compared to the previous year, to 175,000 oz. The major factor in this downward trend was the high price, relative to other materials, which made platinum less attractive for the fashion jewellery sector. However, the picture was not the same everywhere in Europe. UK sales performed well during the first nine months of the year but dropped off in the final quarter. In Germany the decline in manufacturing was steeper throughout the year.

In the UK, platinum is positioned firmly in the price-inelastic bridal sector and jewellery sales were little affected by metal prices. However, retailer profit

margins were affected and demand in the final months of 2006 weakened, leaving the market slightly down overall. Statistics showed a fall of 2.9 per cent in the weight of metal hallmarked over the year but a larger drop in the final quarter.

In Germany, demand fell despite an improvement in consumer confidence. The higher end of the market remained positive but competition from alternative white materials took some of platinum's market in 2006. Swiss fabrication was flat with steady production of platinum watches. The volume of metal consumed by Italian manufacturers dropped, with weak demand in the main export markets the major cause.

### Japan

High metal prices and a weak Yen kept the platinum price at a high level in Japan (although well below its 1980s peak in Yen terms). This had two negative effects on demand: a reduction in industry purchases and a hefty increase in the amount of scrap jewellery being returned by the public for recycling. These trends combined to push demand for new metal almost 30 per cent lower than the year before.

The picture in terms of consumer purchasing was better as platinum maintained its strong position in the bridal market. However, in the fashion sector, although white metal remains attractive to young customers, the choice of metal is becoming less important, leading to competition between white gold and platinum. In all segments, demographic changes continue to drive the potential market lower. With economic growth and inflation still at low levels, the amount of money being spent on jewellery and other discretionary purchases remains quite restricted. Consequently, the weight of an average piece sold has decreased over recent years, contributing to this fall in demand from the Japanese marketplace.

More importantly, though, the volumes of metal returned as scrap increased dramatically in 2006. As platinum prices moved higher than for many years, pawn shops took positive steps to attract a greater amount of jewellery. As a result, large volumes of metal came back for refining and re-supply to the jewellery trade, in the form of rings and also neckchains which had been heavily sold in the 1980s and 1990s.

Japanese demand for new metal therefore fell

substantially in 2006. It continued its long-term downward trend, falling 150,000 oz to 360,000 oz.

### North America

The North American precious metal jewellery market struggled in 2006, with sales of all products more difficult due to rising prices. A large amount of rationalisation of the industry also took place. In this environment, purchases of platinum fell 13 per cent, to 240,000 oz. High prices and volatility prompted the jewellery trade to reduce the amount of inventory held. Some manufacturers also reacted by launching ranges utilising a number of other materials. Although rising prices might have been expected to provide a boost to lower percentage purity materials such as Pt585, little new product was seen in this alloy.

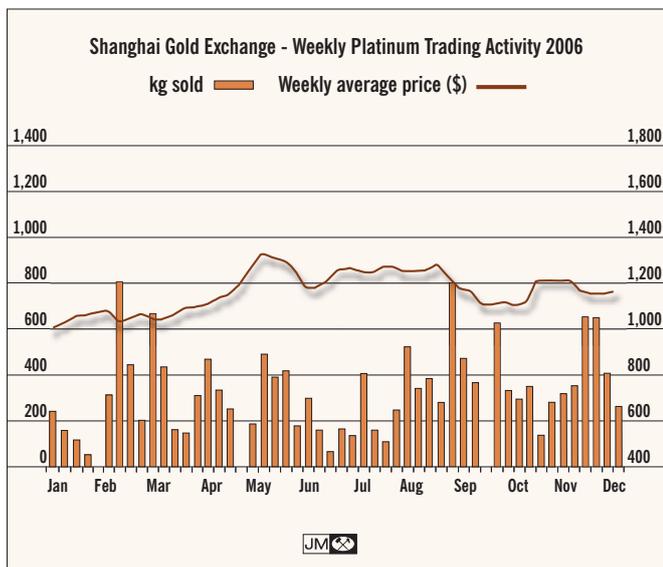
With the price moving higher, it proved difficult to offer attractive fashion products at price points which were competitive with other metals. As a result, platinum uptake for this segment fell, with white gold one of the beneficiaries. Nonetheless, platinum sales in other sectors of the market, particularly the luxury end and the bridal market, remained fairly strong, leading to a more limited overall fall in new metal demand in 2006 than would otherwise have been the case.

### China

Demand for platinum from Chinese jewellery manufacturers contracted by 115,000 oz in 2006 to a total of 760,000 oz, the lowest for any year since 1998. The amount of platinum jewellery produced in China was as much as 300,000 oz higher than this because manufacturers recycled an increased amount of material from old stock.

Purchases of platinum on the Shanghai Gold Exchange (SGE) by the jewellery trade showed a strong negative correlation with the price. As this fell, metal purchases increased while trading conditions were very quiet at times of great volatility, principally in May and November. Although we forecast annual demand of 780,000 oz in our November report, consumption was a little below this. Over 2006, platinum purchases fell 13 per cent under this high price.

Nonetheless, consumer purchases of platinum jewellery stood up well in China, with retailers



*Demand for new metal from Asian jewellery manufacturers was depressed in 2006 due to high platinum prices and large volumes of recycling.*

reporting higher turnover but slightly reduced weight of metal sold. Platinum holds a central place in the bridal jewellery market, whether for diamond solitaire wedding rings or newer matching pair rings. White precious metals remain popular and where competition has been seen, for instance at the lower end of the gem-set segment, white gold has been the major alternative to platinum.

The amount of jewellery collected as scrap, both from the supply chain and from consumers trading in old pieces for newer designs, increased greatly. Much of this metal was recycled and refined before being sold back to manufacturers. Nonetheless, it is clear that the platinum price has had a negative effect on the industry in China, with a decline in the number of manufacturing employees and a significant drop in the amount of metal held as work-in-progress or retail stock. In our view, the pipeline for platinum is now very thin.

With prices at high levels, product and market development gathered some attention during 2006. Some manufacturers launched higher-purity metal only products (Pt999 as compared to the normal Pt950 or Pt990), trading on the consumer desire for high-purity materials. An increase was seen in the promotion of platinum pair rings (one for each partner) in an attempt to increase the weight of metal bought per wedding. It is, however, too early to report confidently on the progress of such activities.

One area, where a clear increase in demand was

seen was the sale of considerable numbers of small beads. These share their name with the word "pig" in much of China and should therefore be lucky for the current Chinese Year of the Pig. Although these are made in a range of metals, including platinum, this single product contributed several thousand ounces of demand to 2006 and will do so again in 2007.

### Rest of the World

Jewellery manufacturers throughout the Rest of the World region (excluding China) bought 36 per cent less platinum in 2006 than in 2005, with a total demand of 70,000 oz. Most platinum demand outside the major consumer markets is derived from manufacturing jewellery for export. A high metal price has negatively affected demand in all regions. With the quantity of finished jewellery being imported into the major economic regions falling, manufacture in the Rest of the World region also declined.

### CHEMICAL

**Overall demand from the chemical industry for platinum grew by 35,000 oz to a total of 360,000 oz in 2006, with its use in the production of paraxylene, silicones and nitric acid once more the key areas.**

Demand for platinum gauze from the nitric acid industry remained largely flat. As previously reported, manufacturers of nitric acid have been reducing the metal content in their burners and the high price of platinum in 2006 did nothing to discourage that trend. However, after a flat year for fertiliser demand (one of the major destinations for the acid produced) in 2005, last year saw a return to growth, with expansions in production capacity in both North America and Asia.

Platinum catalysts are also used in the manufacture of purified terephthalic acid (PTA). The precious metal is used in the production of paraxylene which is converted in turn into PTA. Demand for PTA is growing at 7-8 per cent per annum due to its use in polyesters for clothing and polyethylene terephthalate for packaging.

Platinum Demand: Chemical '000 oz		
	2005	2006
Europe	100	100
Japan	50	50
North America	100	105
Rest of the World	75	105
<b>Total</b>	<b>325</b>	<b>360</b>

Much of this growth is in Asia, and manufacturers have been adding plant capacity in China and elsewhere in the Rest of the World region, increasing platinum demand. This growth is expected to continue, as other new large scale paraxylene plants are being planned.

The most significant chemical application in terms of metal consumed is the use of platinum catalysts in the production of silicones for pressure release applications. In these, the platinum-containing catalyst is trapped within the silicone products formed and is therefore lost during the manufacturing process. Although this market (which is only a small part of the global silicone market) is growing, manufacturers continue to work on thriftig the metal content of the catalyst, with the effect of restraining net growth in demand for this application to a low level.

**ELECTRICAL**

**Platinum demand from the electronics and electrical sectors was strong in 2006, rising by 18 per cent to 425,000 oz. Continuing rapid expansion in hard disk manufacturing was the most important factor, contributing 245,000 oz.**

Platinum Demand: Electrical '000 oz		
	2005	2006
Europe	40	45
Japan	65	75
North America	95	100
Rest of the World	160	205
<b>Total</b>	<b>360</b>	<b>425</b>

The consumer electronics industry had a good year in 2006, with computer sales rising 10 per cent, boosting the number of hard disks needed. Platinum use in the magnetic recording layer of hard disks rose in line with the volumes of hard disks shipped. These climbed by more than 15 per cent, to a global total

of over 400 million. Manufacture of this technology is centred on Asia, with the majority of growth seen there. Hard disks using perpendicular magnetic recording technology have started to gain market share - these use similar recording media to conventional hard disks, maintaining the platinum content per disk.

As reported previously, the number of hard disks per device is rising, increasing the platinum content of an average consumer electronics product. On the negative side, smaller, 1 inch diameter, hard disks appear to be losing the fight for dominance in the portable device market to flash memory, limiting net growth rates.

Purchases of platinum for use in thermocouples

in the semiconductor and glass industries also rose, supported by strong consumer electronics sales and continuing expansion of capacity for making flat screen displays. Electroplating of electronic components, often performed to provide corrosion resistance, also continues to represent a sizeable part of the electronic sector's demand for the metal.

Platinum consumption in the fuel cell sector increased in 2006 but remained at a relatively low level. The amount of platinum consumed in prototypes and early manufacturing grew in 2006. The first commercial direct methanol fuel cell products (DMFC), designed to power portable electronic devices and provide auxiliary power, have started to appear on the market, with some platinum demand derived from consumer sales for the first time.

**GLASS**

**Demand for platinum from the glass industry increased by 30,000 oz in 2006, reaching 390,000 oz. Most of this growth was seen in Asia, with increases in production capacity for flat screen displays responsible for the bulk of demand.**

The market for flat screen displays (both LCD glass and plasma display panels) continued its rapid growth in 2006. Although we commented in our 2006 Interim Review that there appears to be significant overcapacity in this market, Asian manufacturers are continuing to invest heavily in order to gain market share. They are therefore building more, and larger, plants than had been forecast. This has led us to upgrade our demand estimate for 2006 as there is considerable evidence that additional metal was purchased for this segment in Japan and the Rest of the World region.

Oposing this, the growing market penetration of flat screen technologies has had a negative impact on traditional cathode ray tube (CRT) manufacturing. A number of such facilities have closed, with platinum being sold back into the market, reducing net demand from the glass industry. However, this process is slowing as many factories had already closed and much of the available pool of metal had been sold.

Platinum Demand: Glass '000 oz		
	2005	2006
Europe	10	10
Japan	95	100
North America	5	10
Rest of the World	250	270
<b>Total</b>	<b>360</b>	<b>390</b>

## PETROLEUM REFINING

The petroleum refining industry increased its demand for platinum in 2006 by 35,000 oz to a total of 205,000 oz. With oil prices having risen almost constantly since 2002, refiners have been operating at full capacity, leading to high replacement rates for catalyst charges. There was also significant construction of new plant in South Asia where most of the growth in demand originated.

An important developing trend is the move towards increasing national energy security. With oil prices high and the chances of supply interruptions appearing to be greater than for many years, the petroleum companies are constructing new refining capacity worldwide. Perhaps most surprisingly, the first completely new US refinery for 30 years has been planned, reflecting a shift

Platinum Demand: Petroleum Refining '000 oz		
	2005	2006
Europe	15	15
Japan	5	5
North America	35	40
Rest of the World	115	145
<b>Total</b>	<b>170</b>	<b>205</b>

in American energy policy.

Much of the expansion in capacity elsewhere around the world is designed to process heavier oil fractions. This typically requires the use of precious metal catalysts (platinum in particular) for the reforming and isomerisation stages.

Of longer-term interest, 2006 (and early 2007) saw announcements on forthcoming gas-to-liquids (or GTL) projects, some of which will use platinum in downstream processing. Exxon has cancelled one major project but Shell is currently constructing a plant in Qatar and other smaller facilities are also being built.

## OTHER

Demand for platinum in other applications rose 15,000 oz in 2006 to 490,000 oz.

Consumption of platinum in the European dental sector was flat in 2006, at 70,000 oz. Reforms made to the German healthcare system resulted in patients becoming responsible for a greater proportion of their treatment costs than previously. With a high platinum price, there has been a considerable incentive to reduce the use of platinum in this application. At the same time, the costs of all-ceramic components have been decreasing, providing more competition for precious

metal alloys and taking some market share, a trend which seems set to continue if current metal prices are sustained.

In the spark plug sector, there is competition between base metal, platinum and iridium plugs. Pgm-based spark plugs continue taking market share due to their superior durability.

Demand for platinum in anti-cancer drugs and biomedical components rose by 3.5 per cent. Its use in turbine blade alloys also exhibited good growth in 2006. (For more details on these two applications, see last year's special feature in our Platinum 2006 market review.)

Platinum Demand: Other '000 oz		
	2005	2006
Europe	175	175
Japan	45	45
North America	220	225
Rest of the World	35	45
<b>Total</b>	<b>475</b>	<b>490</b>

## INVESTMENT

Net demand for physical investment products in platinum fell again in 2006 to a figure of -40,000 oz, with more metal returning to the open market than was bought by consumers. These figures do not reflect purchases or sales in platinum by funds and other institutional investors.

Net sales of platinum investment products, predominantly coins, fell in 2006, to 25,000 oz. Although consumer interest continues, more trade attention was focused on gold coins, with the gold price moving strongly ahead. Sales of the US Mint's bullion platinum American Eagle fell by a third to its lowest ever total of 13,500 oz. The Discover Australia series of coins issued by the Perth Mint added some small additional demand.

The situation in Japan is somewhat different. With a long history of investment in platinum products, there is a large pool of metal which can be returned for recycling under the correct price conditions, just as in the jewellery market. Although there were reasonable levels of investor purchasing of platinum, more metal was released than was purchased, leading to negative net investment over the entire year.

Platinum Demand: Investment '000 oz		
	2005	2006
<b>Coins and small bars</b>		
Europe	0	0
Japan	0	0
North America	25	20
Rest of the World	5	5
<b>Large bars in Japan</b>	<b>(15)</b>	<b>(65)</b>
<b>Total</b>	<b>15</b>	<b>(40)</b>