

PALLADIUM

- Gross demand for palladium decreased by 6.3% to 7.77 million oz in 2009. Net palladium demand (taking into account recycling) fell by 5.0% to 6.34 million oz.
- Open loop recycling returned 1.43 million oz of palladium to the market from scrapped autocatalysts, electronics and jewellery, a decrease of 11.5% from 2008.
- Gross autocatalyst sector demand for palladium decreased by 9.3% to 4.05 million oz in 2009.
- Gross industrial demand for palladium, mostly from its use in the electrical and dental sectors, fell by 5.8% to 2.28 million oz last year.
- Gross palladium demand from the jewellery industry fell by 17.3% to a global total of 815,000 oz.
- Net identifiable physical investment demand for palladium climbed by 48.8% to 625,000 oz in 2009, with higher ETF demand largely responsible.

AUTOCATALYST

Gross global demand for palladium from the automotive sector fell by 9.3 per cent to 4.05 million ounces in 2009. Difficult economic conditions hit vehicle sales and manufacturing volumes in Japan, North America and the Rest of the World region, with metal demand falling substantially in each location. European automotive palladium demand was remarkably robust: the gasoline engine gained market share, supporting palladium demand which fell only by 1.0 per cent to 995,000 oz. Chinese demand for palladium from the autocatalyst sector rose by 75.6 per cent to 685,000 oz, driven mainly by strong growth in light duty vehicle output.

Europe

In Europe, automotive sector purchases of palladium were surprisingly strong in 2009, falling only by 1.0 per cent – 10,000 oz – to 995,000 oz, despite a decrease in light duty vehicle production from 19.3 million units to 16.0 million units.

The opening months of 2009 were extremely difficult for the European automotive industry with the effects of low consumer confidence exacerbated by the limited availability of credit. Production was depressed below the headline rate of sales due to the existence of excessively large inventories of unsold vehicles which made manufacturers unwilling to produce cars which they could not quickly sell. A degree of destocking of catalysts also occurred in the early months of the year, further restricting new metal demand. Little of the catalyst restocking which we had previously forecast occurred in late 2009.

However, midway through the year, a number of European governments introduced incentive schemes to encourage consumers to buy new vehicles, typically in the form of scrappage schemes. The UK scheme was launched in May

2009 and had subsidised 290,000 new vehicle sales by the end of the year, while the hugely successful German scrappage scheme part-financed almost two million vehicle purchases.

The subsidies available proved particularly attractive to purchasers of smaller vehicles, where a greater proportion of the vehicle's cost was subsidised. Most smaller cars are gasoline-fuelled and, despite the 7.2 per cent fall in the sale of new vehicles for the year as a whole in Europe to only 16.8 million units, the gasoline engine gained substantially in terms of market share during 2009. The number of gasoline vehicles manufactured changed comparatively little as a result, and gross palladium demand for the gasoline sector actually increased by some 20,000 oz to 750,000 oz.

Gross palladium demand from the diesel sector decreased slightly. The auto makers continued to increase the proportion of diesel catalysts and filters which used platinum:palladium formulations at the expense of platinum-only technology. The introduction of the first stages of the new Euro 5 emissions rules in late 2009 drove the fitment of diesel particulate filters to an increasing proportion of new vehicles too. Overall, therefore, there was a healthy increase in the average amount of palladium in a diesel aftertreatment system during the year.

This was, though, outweighed by the impact of the temporary fall in the market share of the diesel engine. Palladium use in the diesel sector decreased to roughly 245,000 oz, although demand is expected to return to growth during 2010 as this market segment starts to recover. Overall, palladium represented roughly twenty per cent of the platinum group metals used in the European diesel sector during 2009.

Japan

Japanese auto makers purchased a gross 590,000 oz of palladium for use on domestically-produced automobiles during 2009, one third less than in the previous year.

The economic downturn had little impact on Japanese automotive output during 2008 with exports remaining strong until the end of that year. The sharp downturn in sales was therefore reflected more strongly in reduced manufacturing volumes in 2009 than was the case in other regions where the slowdown was felt earlier. Japanese passenger car production fell by 30.9 per cent, from 9.9 million units to a weak 6.9 million units. The manufacturing of vehicles for export and for the domestic market were both affected. Vehicle output should recover to some extent in 2010 although it will not rise back to the levels reached in 2008 this year.

The introduction of the Post New Long Term light duty and JP09 heavy duty emissions regulations occurred in the Japanese market in 2009. However, manufacturers continue to voluntarily meet tighter emissions standards similar to those in place in the USA. This means that catalyst loadings are regularly increased to meet new limits, offsetting the effects of continuing work on thrifting (reducing the metal loading without negatively affecting catalyst performance).

In almost all of Japan's export markets, tighter emissions rules are continually being introduced. This forces the fitment of increasingly heavily-loaded catalysts in order to reduce regulated emissions, supporting metal demand. Palladium demand was further boosted by the continued steady replacement of platinum-based catalyst formulations on gasoline vehicles by palladium-based technology, made possible by better quality fuel in these export markets.

North America

Gross demand for palladium from the North American automotive sector fell by 20.9 per cent to 1.02 million ounces in 2009, the lowest figure since 2002.

Vehicle sales were weak throughout 2009, running at levels substantially below those seen in recent years. At the start of the year, confidence in the US economy slumped to extremely low

Palladium Demand: Autocatalyst '000 oz						
	Gross		Recycling		Net	
	2008	2009	2008	2009	2008	2009
Europe	1,005	995	(310)	(280)	695	715
Japan	885	590	(70)	(50)	815	540
North America	1,290	1,020	(670)	(540)	620	480
China	390	685	(30)	(35)	360	650
Rest of the World	895	760	(60)	(60)	835	700
Total	4,465	4,050	(1,140)	(965)	3,325	3,085

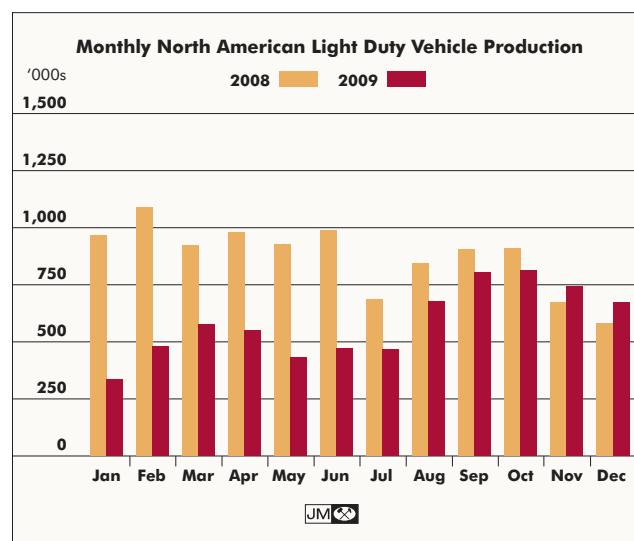
Extremely strong growth in car production in China proved to be one of the few bright points for automotive palladium demand in 2009.



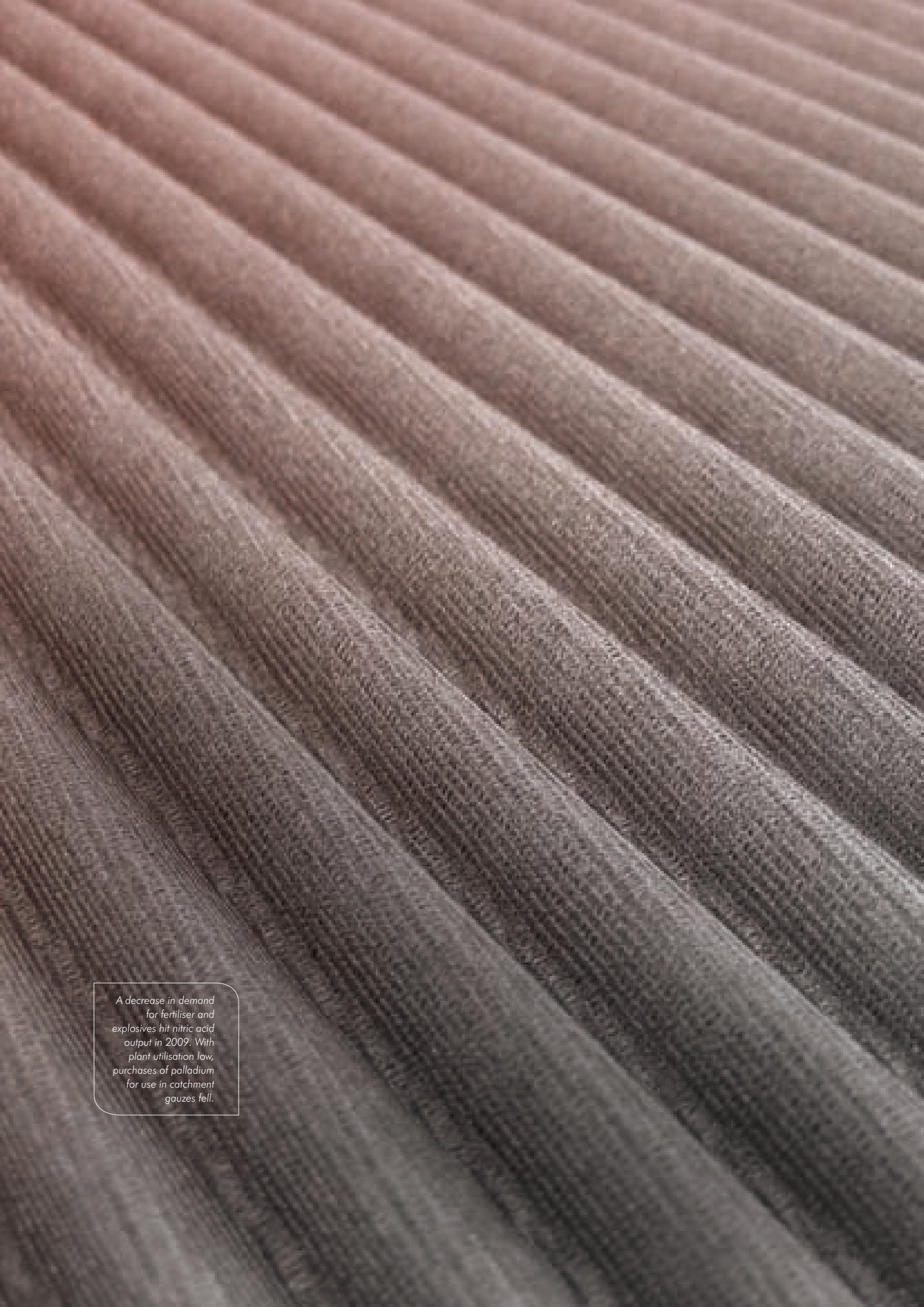
levels. The financial problems being experienced by some of the largest auto makers made consumers wary of purchasing new vehicles and a lack of available credit depressed leasing too, driving sales sharply lower. Palladium demand was further hurt by consumers' desire to downsize their vehicles: the average engine displacement of a new car or truck fell again last year, dragging the size of a typical catalyst lower and further trimming palladium demand.

With large stockpiles of unsold vehicles in existence at the start of 2009, production rates underperformed even the weak level of sales as the industry attempted to cut inventories. Light duty vehicle output fell by 32.7 per cent to 7.1 million units.

Sales and production only started to rise once the "Cash for Clunkers" scrappage scheme was introduced in the middle of the year in the USA. A gradual improvement in the prospects for



North American light duty vehicle production was weaker in 2009 than in 2008 although output gradually improved during the year.



*A decrease in demand
for fertiliser and
explosives hit nitric acid
output in 2009. With
plant utilisation low,
purchases of palladium
for use in catchment
gauzes fell.*

the economy encouraged consumers to return to more normal levels of buying interest in the final months of the year after this scheme ended. This drove additional increases in working stocks of catalysts, supporting palladium demand.

China

The continuing rapid growth of the Chinese economy encouraged high levels of discretionary spending throughout most of 2009. An expansion in the availability of corporate and consumer credit helped drive record passenger car production of 8.4 million units, some 47.6 per cent higher than one year before, with most of these vehicles sold within China. Demand for palladium soared 75.6 per cent from 390,000 oz in 2008 to 685,000 oz in 2009.

Most of the vehicles manufactured and sold within China are gasoline-fuelled and the majority of platinum group metal demand is therefore for palladium. Euro 3 equivalent rules were introduced across most of China in mid-2009 (with Euro 4 rules being introduced in Beijing, Guangzhou and Shanghai) and manufacturers responded by fitting higher-loaded catalysts – increasing the average precious metal loading of a new vehicle – and replacing platinum-based catalysts with palladium-based formulations in many cases. This was, however, offset to some extent by the Chinese Government's reduction in purchase taxes on smaller vehicles (with engines of below 2.0 litres) and a range of other incentives which drove slight decreases in both average engine size and average catalyst size.

Rest of the World

Gross demand for palladium from the autocatalyst sector in the Rest of the World region dropped by 15.1 per cent to 760,000 oz last year as vehicle production tumbled.

In Russia, the weakness in the global economy was exacerbated by the fall in oil and natural gas prices. With the economy struggling, sales of new vehicles slumped by over half. There has been relatively little recovery in this market to date although the introduction of a scrappage scheme in 2010 could provide some boost to sales. Mexican vehicle production also slumped due to the marked weakness in the economy of the USA, its key export market. Palladium demand dropped sharply in both countries.

There were, however, a few bright spots such as Brazil where early government action, in the form of cutting purchase taxes on new cars, supported the market for the entire year, with production increasing as a result.

JEWELLERY

Gross global demand for palladium from the jewellery sector fell by 17.3 per cent to 815,000 oz in 2009. (Due to a decline in the recycling of old jewellery, net demand was down by only 12.9 per cent to 745,000 oz.) Gross demand due to Chinese manufacturing of palladium jewellery fell by 24.3 per cent from the previous year's levels to 560,000 oz, as manufacturers increased their output of platinum jewellery at the expense of palladium. Combined gross demand from jewellers in Europe and North America increased to a total of 110,000 oz.

China

Gross demand for palladium from the Chinese jewellery sector slipped from 740,000 oz in 2008 to 560,000 oz in 2009.

Demand for platinum was exceptionally strong last year and profit margins for platinum jewellery increased at the manufacturer level. As a result, many manufacturers who had previously produced palladium jewellery alongside platinum concentrated their resources on the more profitable market sector – platinum jewellery – reducing the capacity available for palladium jewellery production. Some manufacturers stopped making palladium jewellery entirely and reduced their stocks of raw materials, driving demand lower still.

The retail picture for palladium jewellery is still mixed within China. Palladium retains a strong position in some provinces, particularly in the West and North-East of the country but is rarely seen on sale in the more affluent Eastern provinces.

At this level, the geographical distribution of palladium



The introduction of the new palladium hallmark boosted demand for palladium from the UK jewellery industry last year.

See notes to table on page 29.

Palladium Demand: Jewellery						
'000 oz						
	Gross ¹		Recycling ²		Net ³	
	2008	2009	2008	2009	2008	2009
Europe	45	50	0	0	45	50
Japan	115	120	(40)	(20)	75	100
North America	60	60	0	0	60	60
China	740	560	(90)	(50)	650	510
Rest of the World	25	25	0	0	25	25
Total	985	815	(130)	(70)	855	745

jewellery appears to be driven by interest from individual wholesalers and retail chains and by the amount of disposable income in the area, rather than by latent customer demand.

Palladium availability is therefore not uniform even within a province: although it is sold in second and third tier cities, it is seldom present in the central shopping areas of the major cities. Growing affluence means that an increasing number of rural consumers are travelling into these areas to purchase jewellery, limiting the potential sales of palladium.

The stocks of the Pd950 (95 per cent purity) jewellery which were originally manufactured in China in 2004 and 2005 are now almost exhausted. From 2006 to 2008, significant quantities of this stock returned to manufacturers for refining and remaking into higher-purity Pd990 pieces. With less of this remanufacturing occurring last year, gross demand fell by a greater percentage than did net demand.

We have previously commented on the purchase of palladium in China for short term speculative uses rather than for manufacturing into jewellery. We believe that at least 150,000 oz of metal entered China for this purpose during 2008 and that further speculative investment took place at the start of 2009 as prices remained low. The high palladium price of early 2010 appears to have brought some of this metal back to the market, supporting our decision not to include it in our demand figures initially. Indications of the scale of this returning metal flow – which was larger than originally expected – have led us to downgrade our figure for palladium jewellery demand within China for last year.

Other Regions

In Europe, palladium made some progress in the jewellery sector during 2009 and gross European jewellery sector demand rose by 11.1 per cent to 50,000 oz. In the UK, a hallmark was granted in the second half of the year, encouraging manufacturers to add palladium to their product ranges and

affirming its status as a bona fide precious metal.

In a number of European countries, the introduction of palladium men's wedding bands allowed palladium to capture some market share from other white metals, augmenting demand. In Germany, for example, most manufacturers now include palladium bands in their wedding collections. Most European sales continue to be for men's rings but there are reports of the sale of a small number of palladium engagement rings, reflecting the establishment of palladium as a jewellery metal to a limited extent. In Switzerland, however, production of luxury watches – including those made from palladium – weakened as demand for these high-end items slowed.

Gross North American jewellery demand for palladium was unchanged at 60,000 oz last year. Manufacturers have now been developing expertise and product ranges in palladium jewellery for several years. This has improved the availability of palladium products but progress remains slow at the retail level. Consumers were greatly affected by the economic malaise of 2009 and marrying couples found their budgets squeezed. The more attractive price of palladium allowed it to capture a small additional share of the men's wedding band market. However, palladium faced competition from other materials including base metals and demand was almost static.

Gross palladium consumption in the Japanese jewellery market in 2009 increased by 5,000 oz from 2008 levels to 120,000 oz. Very little palladium jewellery is produced or sold within Japan. Instead, demand derives from its use as a minor alloying element in platinum and white gold jewellery. The Japanese platinum market performed relatively well last year with manufacturing volumes marginally higher than in the previous year.

CHEMICAL

In the chemical industry, palladium is used in the production of four major bulk chemicals: hydrogen peroxide, nitric acid, purified terephthalic acid (PTA) and vinyl acetate monomer (VAM). The weakness in the global economy, and the expected cyclical slowdown in the construction of new production capacity for these chemicals, hit chemical sector demand which fell from 350,000 oz in 2008 to 325,000 oz last year.

Purchases of palladium for use in nitric acid catchment gauze – to capture the platinum lost from the main burner gauzes in low to medium pressure reactors – decreased in 2009. Global production of nitric acid fell at the start of the year and many facilities were run at very low throughput, with

some even being mothballed, causing a decline in the number of replacement catchment gauzes required. A slow recovery in demand for nitrogen-based fertilisers and explosives should lead to enhanced nitric acid production in 2010 and higher palladium requirements for this application.

Although global demand for PTA and VAM for the manufacture of products ranging from plastic bottles to paints fell during 2009, this decline did not occur in every region. The Chinese market performed relatively strongly and further plant capacity was installed in 2009, leading to additional palladium demand for process catalysts. After several years of rapid expansion, demand in the Rest of the World region, largely from plant construction in Asia and the Middle East, fell as fewer new facilities were built.

Palladium is also used in the production of hydrogen peroxide by the hydrogenation of alkylated anthraquinones. This process is cleaner than many other routes to produce this industrial bleach and environmental drivers encouraged the addition of further capacity, supporting palladium demand.

Palladium Demand: Chemical '000 oz			
	2007	2008	2009
Europe	95	100	85
Japan	25	20	20
North America	75	55	50
China	80	55	75
Rest of the World	100	120	95
Total	375	350	325

DENTAL

Net usage of palladium in the dental sector continued to decline slowly in 2009, falling from 625,000 oz a year earlier to 615,000 oz. Demand for palladium from the Japanese dental industry remained flat at 275,000 oz, while North American palladium demand decreased by 10,000 oz to 260,000 oz. Demand in other regions remains low.

The long term trend in palladium demand within Japan remains one of gradual decline as its population falls, dental health improves and as other technologies such as all-ceramic treatments capture some market share. A number of dental suppliers also moved to just-in-time delivery, reducing industry stocks of palladium. However, less metal was recovered from scrap alloy than in 2008 and net demand remained steady.

Kinpala alloy (a mixture of gold, silver and palladium) continues to attract a subsidy from the Japanese Government

Palladium alloys such as Kinpala are used in a range of dental treatments within Japan.



encouraging its use in dental treatments such as crowns and bridgework. Surprisingly, though, the subsidy was lowered slightly in October at its twice-yearly review, despite the increase in the raw material prices, suggesting that demand may weaken this year as dentists and patients increasingly opt for other, non-precious metal treatments.

In North America, palladium is primarily used as a component of low gold content alloys used in dental treatment. These compete in the same applications – bridgework and restorations – as higher gold content alloys. The rising gold price was therefore more influential than any changes in the palladium price: with gold trading above \$1,000 an ounce for much of the year, there was a clear financial incentive for dentists and those receiving dental treatment to switch to higher-palladium, lower-gold content alloys, where this had not previously happened.

However, as in other areas of the dental market, precious metal alloys are slowly losing market share to other treatments such as all-ceramic crowns. The switching that did occur into palladium-rich alloys therefore merely limited the decrease in North American dental demand to 10,000 oz.

Palladium Demand: Dental '000 oz			
	2007	2008	2009
Europe	70	65	65
Japan	275	275	275
North America	265	270	260
China	5	0	0
Rest of the World	15	15	15
Total	630	625	615

ELECTRICAL

The electrical sector purchased a gross 1.27 million ounces of palladium during 2009, 7.3 per cent less than in the previous year, as the global economy hit consumer purchasing and drove widespread inventory reductions at all levels of the industry.

As in many other sectors, output from the electronics industry was severely depressed in the earlier parts of 2009 before recovering to much healthier levels later in the year. Looking at the whole of 2009, purchasing of consumer electronics was at relatively similar levels to the previous year. However, overall electronics output was driven lower by weak business investment and by low demand for automotive electronics, causing palladium demand to fall.

Demand for palladium was also reduced due to widespread destocking of materials, components and finished goods throughout the electronics industry. This process took place during the first half of 2009 and, although some restocking began later in the year, the net impact was a further reduction in palladium demand.

In the multi-layer ceramic capacitor (MLCC) sector, palladium was again used in some 10-15 per cent of all MLCC produced. The longer term trends of recent years continued, though: miniaturisation of electronic devices once again drove down the average size of a MLCC as more of the smallest 0201 and 01005 case size capacitors were produced – these now account for more than ten per cent of the MLCC market.

However, the increasing complexity of electronic devices has also led to the use of significantly higher numbers of passive components such as MLCC, balancing the effects of miniaturisation and maintaining the typical palladium content of a device. Overall, annual demand for palladium from this specific application slipped to just below 600,000 oz.

Palladium demand for use in silver-palladium alloys employed in the conductive tracks in hybrid integrated circuits (HICs) fell last year due to the weakness in the automotive market where many of these HICs are used.

In many of its other electronic applications – particularly plating – palladium competes with gold. The gold price was extremely buoyant during 2009, rising to record levels. Thus, although the palladium price rose strongly throughout the year, the economic incentive to replace gold with palladium persisted. However, this price differential has existed for a number of years now and relatively little further switching took place in 2009. Palladium demand from this application fell by some ten per cent due to destocking and soft consumer sales.

Palladium Demand: Electrical
'000 oz

	Gross		Recycling		Net	
	2008	2009	2008	2009	2008	2009
Europe	190	175	(140)	(160)	50	15
Japan	320	305	(60)	(55)	260	250
North America	170	155	(55)	(70)	115	85
China	255	235	(20)	(25)	235	210
Rest of the World	435	400	(70)	(85)	365	315
Total	1,370	1,270	(345)	(395)	1,025	875

The weight of palladium recovered from end-of-life electronics increased substantially in 2009. Environmental legislation and the high prices of gold and copper stimulated higher recycling of used electronic devices. As a result, net electronics demand fell by a greater percentage than gross demand, decreasing by 14.6 per cent to 875,000 oz. For more information on the recycling of end-of-life electronics, please see page 24.

INVESTMENT

Identifiable physical investment demand for palladium climbed by 48.8 per cent to a record annual total of 625,000 oz in 2009. The purchase of coins and small bars generated 95,000 oz of demand in North America,



The sale of products like this Canadian Maple Leaf coin helped drive demand for coins and small bars up to 95,000 oz last year.

significantly more than the previous year's figure. Exchange Traded Fund (ETF) investors also showed a greater appetite for palladium, with demand rising by 160,000 oz to a substantial 530,000 oz.

The Royal Canadian Mint restarted production of its one ounce palladium Maple Leaf coins in mid-2009 having not minted any of these coins during 2008. A rising gold price prompted strong individual investor interest in precious metal products including palladium. With relatively few previously-minted palladium Maple Leafs in circulation, demand for these items was particularly healthy, helping to boost demand for coins and small bars in total to some 95,000 oz.

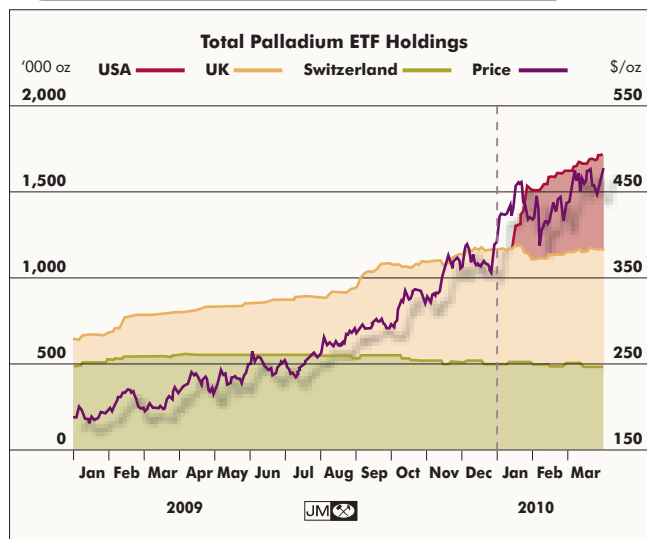
ETF demand also climbed, rising from 370,000 oz in 2008 to 530,000 oz in 2009. Almost all of this demand reflected flows into the European ETFs with only 5,000 oz entering the Australian ETF which was launched in January 2009.

Combined Exchange Traded Fund positions rose from 645,000 oz of palladium at the start of 2009 to a record level of 1.17 million ounces at the end of the year, as European investors demonstrated their confidence that the palladium price would continue to rise.

In 2008, the Swiss fund accounted for most of the ETF purchasing which took place. In 2009, although the Swiss fund saw reasonable levels of buying at the start of the year, taking its holdings from an initial 490,000 oz to 550,000 oz, redemptions in the final quarter meant that net metal inflows into this fund for the year were close to zero. Total holdings continued to decline during the first quarter of 2010, suggesting that some investors have chosen to realise profits with the palladium price above the \$400 level.

In sharp contrast, investors continued to add to their positions in the London fund throughout 2009, taking holdings from 155,000 oz to 670,000 oz at the end of the year, following their weighty redemptions of metal in the second half of 2008. Anecdotal evidence suggests that these investors have a wide range of different investment timescales. Some investment inflows may have been encouraged by the rapid rise in the

Investors once again increased their holdings of palladium in the European Exchange Traded Funds last year, leading to record investment demand.



palladium price throughout much of the year. However, the slow recovery in the automotive market and speculation over the size and future fate of Russian state stocks of palladium provided enough incentive to attract investors with bullish longer term views, adding to demand.

The launch of the US-based palladium ETF in January 2010 came too late to affect metal uptake for 2009 but should raise demand substantially once again this year: by March 2010, total positions in this fund stood at 540,000 oz, although purchasing has since slowed.

OTHER

Palladium demand from all other applications fell from 75,000 oz in 2008 to 70,000 oz in 2009. Small but rising amounts of metal were used in pollution control from off-road sources and from small engines. More palladium was also used in hydrogen purification equipment than in the previous year. Demand for palladium for control of emissions from stationary sources increased but the use of palladium in brazing alloys fell.

Palladium Demand: Investment '000 oz			
	2007	2008	2009
Europe	280	370	525
Japan	0	0	0
North America	(20)	50	95
China	0	0	0
Rest of the World	0	0	5
Total	260	420	625

Palladium Demand: Other '000 oz			
	2007	2008	2009
Europe	20	20	20
Japan	10	10	10
North America	30	20	15
China	10	10	10
Rest of the World	15	15	15
Total	85	75	70