

Palladium



Autocatalyst

Purchases of palladium by the autocatalyst sector are forecast to recover by almost 19 per cent in 2003 to 3.67 million oz as US auto companies use far less metal from inventories than in 2002. The underlying use of palladium on autocatalysts in the USA will fall, however, as intensive thrifting has continued to reduce metal loadings. Japanese autocatalyst palladium demand is forecast to rise in advance of tighter emissions regulations but European purchases will weaken in line with a drop in gasoline car production.

Europe

European demand for palladium in autocatalysts is forecast to fall by 7 per cent in 2003 to 1.31 million oz. Auto industry forecasts suggest sales of gasoline cars in western Europe could decline by as much as 6.5 per cent in 2003, dropping to between 8.2 and 8.3 million vehicles as diesels gain further market share. With the majority of gasoline vehicle catalysts in Europe based on palladium, the fall in car output will have a direct impact on demand for the metal.

A minority of auto manufacturers in Europe moved to greater use of platinum versus palladium in gasoline autocatalysts when the price of the latter soared to over \$1,000 in early 2001. That process may now be reversed as the palladium price has fallen back and the discount between palladium and platinum has widened to more than \$500 per oz.

For those companies that produce a substantial volume of diesel cars, a move back to palladium on their gasoline models would help to offset their growing requirement for platinum as sales of diesels in Europe increase. Any switch back towards palladium, however, is not expected to affect metal demand materially until 2004 at the earliest.

Japan

Demand for palladium in autocatalysts in Japan is forecast to rise to 540,000 oz in 2003, an increase of 4 per cent. Car output is projected to fall by 3.8 per cent as manufacturing of vehicles for export markets is increasingly carried out overseas. However, purchases of palladium will rise in comparison to 2002, as there has been little or no use of metal from inventories by Japanese auto makers in 2003.

Consumption of palladium on autocatalysts will also rise as average loadings of pgm on autocatalysts are

edging higher in Japan in advance of more stringent exhaust emissions limits that are due to be applied from the end of 2005.

Given the relatively conservative purchasing strategies adopted by most Japanese car companies towards pgm, no significant changes to overall metal ratios on autocatalysts are forecast in the short-term.

North America

The North American auto industry is expected to purchase 1.31 million oz of palladium in 2003 – a dramatic increase on the previous year when very heavy use of metal from inventories reduced purchases to just 640,000 oz. The reduction in stock levels, as well as the sale of some palladium back to the market, has continued in 2003 but at a much lower rate than in 2002.

In contrast to the increase in purchases of metal, however, use of palladium on autocatalysts by US manufacturers will drop sharply in 2003. The volatility of the metal's price in 2000 and 2001 resulted in pgm thrifting programmes being accelerated in the USA, where there had been relatively intensive use of palladium on autocatalysts. The success of auto companies and catalyst manufacturers in reducing palladium loading levels has had a substantial impact on their use of the metal in 2003.

Lower light vehicle production will also have an impact on the US auto industry's palladium requirements – vehicle output is forecast to slip by 2.6 per cent to 11.7 million units in 2003.

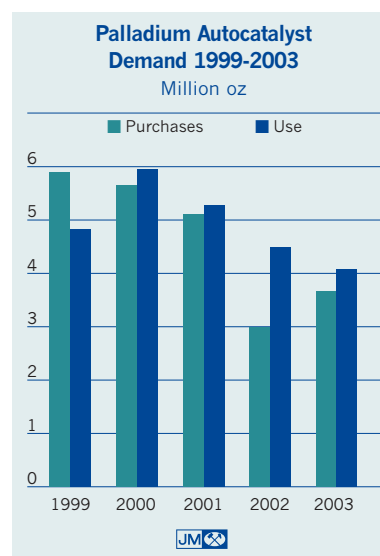
In May, General Motors commented that it was looking closely at the economic benefits to be gained by altering pgm ratios in favour of palladium at the expense of platinum in gasoline autocatalysts. Indeed, the company noted that moves to switch from one metal to the other had already been initiated in some applications. Other manufacturers, however, have not announced any significant changes in their approach to pgm use and the overriding emphasis throughout the industry in North America remains one of thrifting overall pgm loadings.

Rest of the World

Auto industry demand for palladium in the Rest of the World region is projected to weaken in 2003 to 510,000 oz, a fall of 2 per cent.

Chinese demand for palladium is expected to rise strongly in line with the rapid growth in car sales and

	2002	2003
Europe	1,410	1,310
Japan	520	540
North America	640	1,310
Rest of the World	520	510
Total	3,090	3,670
Autocatalyst recovery	(370)	(410)





Palladium

Palladium Demand: Dental '000 oz		
	2002	2003
Europe	45	45
Japan	505	530
North America	210	230
Rest of the World	10	10
Total	770	815



production. South Korean car output is also expected to grow in 2003. This growth, however, will be offset by weaker light vehicle output in Japan, Western Europe and Mexico. On top of this, thrifting of palladium on autocatalysts, particularly on vehicles manufactured in Mexico for the US market, will have a noticeable impact on metal demand in 2003.

Autocatalyst Recovery

The recovery of palladium from recycled autocatalysts is projected to grow by 11 per cent to 410,000 oz in 2003. As is the case with platinum, recovery of palladium will grow the most in Europe. An increasing proportion of cars now being scrapped in the region are fitted with catalytic converters, while the percentage of converters removed prior to cars being shredded is also rising. Recovery is also set to increase in the USA, where the palladium content of catalysts entering the recycling chain is starting to rise – a reflection of the use of palladium-intensive catalysts from the mid-1990s onwards.

Dental

Demand for palladium in dental alloys is expected to recover further in 2003, lower prices stimulating demand in North America and Japan. Permanent substitution of palladium has occurred in the European market, however, and demand in this region is forecast to remain flat. Overall palladium demand is projected to increase by 6 per cent to 815,000 oz.

Although purchases of palladium by the electronics industry will improve in 2003 following a run down in stocks the previous year, miniaturisation and thrifting have continued to reduce use of the metal in components.

Palladium Demand: Electronics '000 oz		
	2002	2003
Europe	90	125
Japan	150	230
North America	225	240
Rest of the World	10	10
Total	750	985



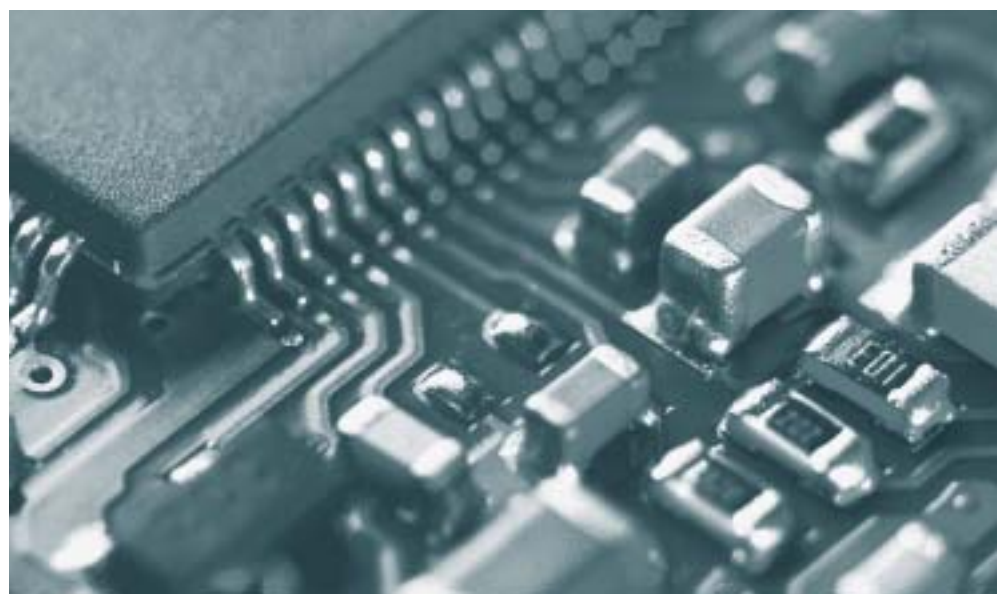
In Europe, palladium-based dental alloys have lost much of their market to alternative alloys and non-metallic materials due to the rapid run up in the price in 2000. This substitution increasingly appears to be permanent – the fall in the price of palladium in 2002 and 2003 has had little effect on demand. The European dental industry has shown no desire to move back to palladium, having invested heavily in the use of competing formulations and remaining wary of the volatility of the metal's price.

In Japan, where patients can reclaim a proportion of the cost of the commonly used 'kinpala' palladium-based alloy, demand is set to improve in 2003. The fall in the palladium price has made dental treatment with kinpala alloy more affordable and total palladium demand is forecast to rise to 530,000 oz. On the negative side, however, patients now have to pay an increased proportion of the cost of treatment.

Lower metal prices also led a recovery in North American demand for palladium in dental alloys during the first nine months of the year and demand for 2003 as a whole is forecast to rise 9.5 per cent to 230,000 oz. The competitive position of palladium-based products has been further improved by the strength of the gold price during 2003, which has seen high-gold alloys losing market share.

Electronics

Purchases of palladium by the global electronics industry are expected to rise by 31 per cent in 2003 following two years of very weak demand.





With excess inventories of both palladium and components having largely been eliminated in 2002, purchases of metal are forecast to climb to 985,000 oz this year. The underlying consumption of palladium in electronic components, however, is projected to weaken by 7 per cent in 2003 due mainly to the continued miniaturisation of capacitors and thrifting of palladium by manufacturers of capacitors and hybrid integrated circuits.

Shipments of multi-layer ceramic capacitors (MLCC) have grown rapidly in 2003, with total sales for the year forecast at almost 600 billion, up from a little over 500 billion in 2002. Rising demand for mobile phones (particularly the latest generation of handsets incorporating digital imaging technology) and strong growth in the overall Chinese market for electronic goods are driving component orders.

A 14 per cent increase forecast for palladium-based MLCC production in 2003 will not, however, translate into higher palladium demand. In fact, use of the metal by the MLCC industry is predicted to decrease slightly. The ongoing trend in miniaturisation will have a significant effect on capacitor raw materials demand. The latest generation of MLCC was launched in the second half of 2003. These capacitors are approximately 70 per cent smaller in volume terms than the smallest existing products (which in turn, are over 78 per cent smaller than their predecessors) and are expected to be widely used in mobile communications applications.

In addition, MLCC producers have continued to thrift the palladium content of the palladium-silver conductive pastes used in capacitor manufacture. Over the last five years, the palladium content of pastes used in certain product lines has decreased from around 30 per cent to 20 per cent.

Furthermore, nickel products are expected to take additional market share from palladium-based MLCC in 2003. Although the pace of substitution has slowed as the price of palladium has dropped, further replacement by nickel is predicted in the future.

At the same time, manufacturers of hybrid integrated circuits (HIC) have also successfully thrifted palladium use in conductive pastes by up to a quarter in some instances. This will result in a substantial reduction in palladium consumption in HIC in 2003.

Demand for palladium used in surge resistors is also set to fall but this will be countered by growing use in varistors and actuators. Use of palladium in the plating

of lead frames is expected to be largely stable as movements in the price of palladium and gold have made the former more competitive.

On a regional basis, demand for palladium in the electronics sector is shifting increasingly towards China and South East Asia. Manufacturers in North America and Japan in particular have established production facilities in Asia to take advantage of lower costs and proximity to the fastest growing markets.

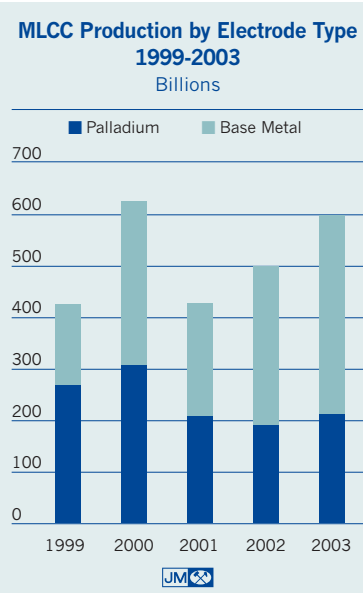
Other

Palladium demand from other applications is forecast to weaken slightly in 2003 to 590,000 oz. Demand from the jewellery sector will fall in line with lower production of alloys containing palladium in Japan and China. Chemical industry demand for palladium-based process catalysts will also soften although this will largely be offset by an upturn in the use of palladium gauze by nitric acid producers.

Demand for palladium in jewellery alloys is expected to drop by 6 per cent to 245,000 oz in 2003. Palladium is a common constituent of platinum alloys used in the Japanese jewellery market; palladium-platinum alloys offering good all-round casting and machining properties. Palladium purchases by Japanese fabricators will fall in 2003 because of the same combination of lower retail sales and inventory recycling that will affect platinum demand. The scale of the drop, however, will be moderated somewhat due to the increased market share taken by white gold, in which palladium is often used as a whitening agent.

In contrast, Chinese jewellery manufacturers are tending to use less palladium in white gold alloys, substituting cheaper metals such as nickel, contributing to a projected drop in palladium demand.

Purchases of palladium for use in the chemical industry are forecast to weaken marginally to 250,000 oz in 2003. The fall in the price of palladium has made palladium catchment gauze more cost-effective for nitric acid producers but as costs and margins in the sector have been under heavy pressure, demand will grow only moderately. In the process catalyst sector, expansion of purified terephthalic acid manufacturing capacity in Asia continues to support good demand for palladium-based catalysts in the region, but demand from the bulk chemicals industry in North America and Japan is expected to soften. The global market for palladium hydrocracking catalysts will be largely stable.



Palladium Demand: Jewellery & Other
'000 oz

	2002	2003
Europe	125	125
Japan	195	190
North America	120	115
Rest of the World	170	160
Total	610	590