

Other Platinum Group Metals

Rhodium

Rhodium demand is expected to reach 573,000 oz in 2000, an increase of 9 per cent compared with last year. Sales of rhodium to auto makers will rise strongly, although this will be partly offset by continued increases in recovery from spent catalysts. Glass demand will also increase, while consumption in other industrial applications will be stable.

Autocatalyst

Automotive demand for rhodium is forecast to rise by 54,000 oz to 563,000 oz in 2000, boosted by higher vehicle production, tighter emissions legislation and changes in the pgm mix in autocatalysts. Our estimate of total demand assumes that there have been no significant increases in auto makers' stocks of rhodium this year, although it is probable that part of a large Russian shipment to the USA in January was acquired by a car company.

In the world's three major auto markets, North America, Europe and Japan, total vehicle output is expected to grow by 2-3 per cent in 2000. Meanwhile, some Asian and Latin American markets have recorded rapid growth this year. For example, passenger car production is forecast to expand by more than 15 per cent in Brazil, China and India, all of which now have legislation requiring new cars to be fitted with catalysts.

Changes in emissions legislation have played a significant role in boosting rhodium demand this year, especially in Europe and Japan. Stage III European emissions legislation came into force in January 2000, leading to an increase in average rhodium loadings. In addition,

we estimate that about 10 per cent of vehicles sold in 2000 will meet tougher emissions standards. Although EU Stage IV regulations will not take effect until 2005, fiscal incentives offered by the German government have encouraged some car companies to fit catalysts capable of meeting stricter limits.

Japan has also seen an increase in rhodium demand in response to new legislation. Japanese Low Emission Vehicle (JLEV) regulations were imposed in October 2000, but many manufacturers had adopted catalysts capable of meeting the new limits ahead of this deadline. Loadings on export models have also increased, in line with tightening emissions limits in Europe and the USA.

In North America, changes in catalyst technology have been an important influence on rhodium demand in 2000. High palladium prices have encouraged some manufacturers to add rhodium to their catalyst systems in order to thrift palladium and reduce overall cost.

The recovery of rhodium from spent autocatalysts continues to grow, with the total expected to increase by 20 per cent to 79,000 oz in 2000. This growth reflects increases in rhodium loadings which occurred in the early 1990s.

Other Demand

Demand for rhodium in other industrial applications is forecast to increase by 8,000 oz to reach 89,000 oz in 2000. Sales to the glass sector are expected to rise sharply this year, as manufacturers in Asia, North America and Europe expand their capacity to produce high-quality thin glass for liquid crystal displays (LCDs). Consumption in other applications will be stable.

Ruthenium & Iridium

Exceptional growth in the world electronics industry has contributed to growth in ruthenium demand, which is forecast to rise by 33,000 oz to 428,000 oz in 2000. Iridium demand is expected to fall by 7,000 oz to 95,000 oz, with lower use in autocatalysts outweighing an increase in demand for iridium crucibles.

Ruthenium pastes are used in the manufacture of resistors, which are found in virtually all electronic devices. This year, world output of resistors is

Rhodium Supply and Demand '000 oz		
	1999	2000
Supply		
South Africa	410	434
Russia	65	280
North America	18	20
Others	8	3
Total Supply	501	737
Demand		
Autocatalyst: gross	509	563
recovery	(66)	(79)
Chemical	34	35
Electrical	6	6
Glass	30	37
Other	11	11
Total Demand	524	573
Movements in Stocks	(23)	164



Ruthenium Demand by Application '000 oz

	1999	2000
Demand		
Chemical	86	68
Electrochemical	72	80
Electronics	196	232
Other	41	48
Total Demand	395	428



expected to rise by over 30 per cent, reflecting a surge in sales of products such as mobile phones, personal computers and digital cameras. Ruthenium demand will increase at a lower rate, around 18 per cent, due to the impact of miniaturisation.

The boom in the mobile phone market has also boosted demand for iridium crucibles, used to grow crystals for electronic applications. These crystals

are used in electronic components known as surface acoustic wave (SAW) filters, which are designed to prevent interference between cell phones.

In the electrochemical sector, demand for ruthenium has risen slightly, while that of iridium has fallen. Although the chloralkali industry as a whole remains depressed, sales of ruthenium have been boosted this year by the recoating of old, ruthenium-only electrodes at some US plants.

The use of ruthenium in chemical applications is expected to decline slightly this year. In recent years, there has been significant consumption in a catalyst used in the Kellogg Advanced Ammonia Process (KAAP); purchases have continued in 2000, but at a lower level than last year. Sales of iridium to the chemical industry – largely for a catalyst used in acetic acid production – will be little changed in 2000.

Consumption of ruthenium in other applications is forecast to rise this year. Ruthenium is used as an alloying

Iridium Demand by Application '000 oz

	1999	2000
Demand		
Automotive	34	14
Chemical	7	6
Electrochemical	28	24
Other	33	51
Total Demand	102	95



element in titanium piping for deep water oil installations; demand is increasing as higher oil prices encourage the reinstatement of mothballed projects.

There will be a sharp decline in the use of iridium in autocatalysts this year. Following the introduction of Japanese Low Emission Vehicle standards, iridium catalysts are being replaced with platinum-rich catalysts on gasoline direct injection vehicles sold in Japan.

Supplies

Rhodium

For 2000, we forecast a very substantial increase in rhodium supplies, up 236,000 oz to 737,000 oz. Clause 19 of Russia's 1999 budget bill was amended in January, clearing the way for the resumption of platinum and rhodium exports; sales of rhodium are expected to total 280,000 oz in 2000, more than four times last year's total. South African supplies are also expected to rise this year.

Despite this overall increase in supplies, there was a shortage of physical availability for much of the first nine months of 2000. Combined with strong consumer demand, this drove the price up to an eight year high of \$2,600 in August. The Russians were absent from the market for much of this period, although there was a surge of selling in

April and again in September; on both occasions, the price quickly retreated to around \$1,700.

While offers of spot metal have been very intermittent, trade statistics reveal that around 160,000 oz of Russian rhodium were imported by the USA in January. This shipment had no impact on market liquidity, and it seems likely that some or all of the metal was acquired by an auto company, either directly from Almaz or through an intermediary.

Supplies of rhodium from South Africa are forecast to rise by 24,000 oz to reach 434,000 oz in 2000. Whereas last year's shipments were slightly below refined output, this year we believe that South African producers have sold some metal from stocks, taking advantage of

higher prices while the Russians were absent from the market.

Ruthenium & Iridium

While supplies of iridium have been sufficient to meet demand, there has been a shortage of liquidity in the ruthenium market this year - even though world production of this metal is sufficient to meet current consumer demand. Sales by South African producers are expected to be lower than refined output in 2000, while Russian exports of ruthenium were negligible during the first eight months of the year. An increase in speculative buying has also contributed to the tightness in the market, with investors purchasing in response to predictions of increasing demand for new industrial applications.