

OTHER PLATINUM GROUP METALS

RHODIUM

Purchases of rhodium expanded by 11 per cent to 812,000 oz in 2005, equalling the previous high recorded in 2000. Use of the metal in autocatalyst, glass and chemical applications increased, but year-to-year changes in inventory levels within the auto industry continued to distort the overall pattern of demand.

Autocatalyst

The use of rhodium in the manufacture of autocatalysts increased only marginally in 2005. In contrast, purchases of metal by auto companies increased by 8 per cent to 821,000 oz. The apparent disparity reflects the fact that there was a significant draw down of inventories of rhodium in 2004, which meant that purchases

of metal in the market lagged behind consumption. With stocks maintained at relatively stable levels in 2005, demand climbed to more closely match the underlying use of rhodium in catalysis.

The US auto industry accounted for much of the year-to-year changes in inventories with demand jumping by 31 per cent to 292,000 oz. The use of rhodium on catalysts, however, increased by a more sedate 3 per cent – this being indicative of the longer-term trend of slowly rising rhodium loadings on gasoline light vehicles which is a result of increasingly stringent limits on NOx emissions.

Rhodium is very effective at catalysing the conversion of NOx to nitrogen, and average loading levels edged upwards in the US in 2005 as the phase-in of Tier II federal emissions standards continued. The Tier II regulations require auto manufacturers to meet an average NOx emissions limit of 0.07 grams per mile across their light vehicle fleets, a reduction of more than 75 per cent from the preceding National Low Emissions Vehicle standards.

However, the rise in the price of rhodium gave auto manufacturers cause for concern during 2005, and is expected to lead to an increased emphasis on thriftiness of the metal in future catalyst formulations.

European auto industry demand for rhodium was stable in 2005 at 180,000 oz. The combined effect of lower production of gasoline vehicles, an increased proportion of cars produced to Euro IV emissions standards, and thriftiness of rhodium on some vehicle models was neutral for metal demand.

Japanese auto manufacturers purchased 216,000 oz of rhodium in 2005, down around 8 per cent compared with the previous year. As in North America, the year-to-year change in demand for metal was a function of additions to inventories made in 2004. The use of metal on catalysts in Japan last year was broadly stable.

Demand for rhodium in autocatalysts in China and the Rest of the World region, increased by 11 per cent to 133,000 oz, reflecting strong growth in production of light vehicles in Asia and South America.

At 137,000 oz, the total volume of rhodium recovered from scrapped autocatalysts edged slightly lower in 2005. Recovery continued to grow in North America and Europe, reflecting changes in the mix of vehicle models reaching the end of their lives and, in Europe, increased vehicle recycling rates due to new legislation. In Japan, however, recovery slipped lower as second-hand vehicles were increasingly exported rather than being scrapped.

Other Demand

Purchases of rhodium for use in the glass industry climbed to a new record high of 55,000 oz in 2005, an annual increase of 20 per cent. The majority of this additional demand stemmed from the ongoing and rapid expansion of LCD glass manufacturing capacity in Asia. Glass producers invested heavily in the construction of new furnaces in order to meet burgeoning orders from manufacturers of LCD and other flat panel displays. Increased rhodium demand was also seen from the fibreglass industry in Asia.

Demand for rhodium for use in catalysts for the chemicals industry was also robust last year, rising by 9 per cent to 47,000 oz. Much of this growth was generated by the construction of new plants for the production of oxo-alcohols and acetic acid.

| Rhodium Supply and Demand '000 oz | | |
|--------------------------------------|------------|-------------|
| | 2004 | 2005 |
| Supply | | |
| South Africa | 587 | 627 |
| Russia | 100 | 90 |
| North America | 17 | 20 |
| Others | 16 | 17 |
| Total Supply | 720 | 754 |
| Demand | | |
| Autocatalyst: gross | 758 | 821 |
| recovery | (140) | (137) |
| Chemical | 43 | 47 |
| Electrical | 8 | 9 |
| Glass | 46 | 55 |
| Other | 14 | 17 |
| Total Demand | 729 | 812 |
| Movements in Stocks | (9) | (58) |



RUTHENIUM & IRIIDIUM

Strong demand from the electronics sector was the driving force behind a substantial increase in ruthenium demand, up 17 per cent to 788,000 oz in 2005. Sales to the chemicals industry softened but remained above the long-term average. Iridium demand recorded a more modest increase, up 3 per cent to 124,000 oz, with growth spread across a range of applications.

| Ruthenium Demand by Application '000 oz | | |
|--|------------|------------|
| | 2004 | 2005 |
| Chemical | 123 | 117 |
| Electrochemical | 96 | 96 |
| Electronics | 388 | 506 |
| Other | 65 | 69 |
| Total Supply | 672 | 788 |

enabled manufacturers to overcome previous limits on storage capacity. There was also a significant rise in inventories of ruthenium held within the industry as hard disk producers, anticipating further growth in consumption, took advantage of relatively low and stable prices to build stocks.

Electronics demand for ruthenium was also boosted by use of the metal in plasma display panels (PDP), which compete with LCD displays in the market for large flat-screen televisions. Manufacturers have been able to enhance the image quality of PDP by incorporating ruthenium into the conductive paste applied to the inner surface of the screen.

Elsewhere in the electronics sector, there was also significant expansion in the consumption of ruthenium in conductive pastes used in resistor components.

Sales of ruthenium to the chemicals industry eased

| Iridium Demand by Application '000 oz | | |
|--|------------|------------|
| | 2004 | 2005 |
| Chemical | 25 | 26 |
| Electrochemical | 27 | 28 |
| Electronics | 30 | 31 |
| Other | 38 | 39 |
| Total Supply | 120 | 124 |

Purchases of ruthenium for use in electronic applications rose sharply in 2005, surging to 506,000 oz. Consumption of the metal in the manufacture of hard disks climbed substantially, driven by strong growth in sales of consumer electronics. The addition of ruthenium to the structure of the disk has

enabled manufacturers to overcome previous limits on storage capacity. There was also a significant rise in inventories of ruthenium held within the industry as hard disk producers, anticipating further growth in consumption, took advantage of relatively low and stable prices to build stocks.

Electronics demand for ruthenium was also boosted by use of the metal in plasma display panels (PDP), which compete with LCD displays in the market for large flat-screen televisions. Manufacturers have been able to enhance the image quality of PDP by incorporating ruthenium into the conductive paste applied to the inner surface of the screen.

Elsewhere in the electronics sector, there was also significant expansion in the consumption of ruthenium in conductive pastes used in resistor components.

Sales of ruthenium to the chemicals industry eased slightly to 117,000 oz in 2005, following two years of very strong demand. Purchases of ruthenium-based catalysts for use in the production of bulk chemicals such as acetic acid edged downwards as less new capacity was brought on stream than in the year before.

Use of ruthenium in the

electrochemical sector was unchanged in 2005 at 96,000 oz whereas demand for iridium moved up to 28,000 oz. This reflected the gradual long-term move towards the use of iridium-ruthenium anode coatings rather than ruthenium-only coatings in the chlor-alkali industry.

Electronics demand for iridium totalled 31,000 oz in 2005, slightly higher than the year before. Iridium's principal electronic use is for the manufacture of crucibles required for the production of high quality single crystals. Demand is concentrated in North America, where expanding sales of positron emission topography (PET) scanners to the medical profession has generated strong growth in production of scintillator crystals.

There were also modest increases in sales of iridium to the chemical and automotive sectors. Iridium, together with ruthenium, is used in a catalyst for the production of acetic acid, and is increasingly used for spark plug electrodes.

RHODIUM SUPPLIES

Supplies of rhodium increased by 5 per cent to 754,000 oz in 2005. South African output climbed by 7 per cent to 627,000 oz as total production of pgm expanded. Anglo Platinum's output of rhodium was also boosted by the release of a significant volume of metal from its process pipeline.

Russian sales of rhodium, however, fell by 10,000 oz to an estimated 90,000 oz in 2005. Norilsk Nickel sold all of its output but only limited quantities of rhodium from state stocks entered the market during the year.

With demand for rhodium growing by more than twice the rate of increase in supplies, the market moved to a deficit of 58,000 oz.

Ruthenium & Iridium

South African output of ruthenium and iridium continued to rise in line with increased production of platinum. The availability of refined metal, however, was insufficient to prevent the price of both metals from strengthening from the second quarter of 2005 onwards, in the face of rising demand and occasional bids for metal from speculators.