OTHER PLATINUM GROUP METALS

- **Global rhodium demand will rise by 4% to top one million ounces, with higher offtake from the auto, glass and investment sectors.**
- **Combined primary and secondary supplies of rhodium will expand modestly, due to increased recoveries from autocatalyst scrap.**
- **Ruthenium demand will rebound strongly, reflecting a recovery in sales to the hard disk industry, but the market will remain adequately supplied.**
- **Consumption of iridium will remain depressed, with the electronics sector making no new investment in crystal-growing capacity this year.**

RHODIUM

This year should see gross demand for rhodium exceed one million ounces for the first time since 2007, lifted by double digit growth in the Chinese auto market, strong sales of rhodium to ETF investors, and a recovery in offtake from the glass industry.

Autocatalyst

World demand for rhodium in autocatalysts is forecast to rise modestly to 801,000 oz in 2013, driven by sharply higher vehicle output in China. Rhodium usage in the other major regions will be broadly flat, but we expect a slight drop in consumption in some smaller markets such as India and South Korea, where gasoline car production is set to decline this year.

Over 95% of auto demand for rhodium is derived from its use in three way catalysts (TWCs) for light duty gasoline applications. China is by far the world's largest producer of gasoline vehicles, and the vast majority of these use palladium-rhodium catalysts to meet local emissions limits. In 2013, we anticipate no significant changes in pgm loadings used by Chinese auto makers, and rhodium demand will therefore rise at a double digit rate, in line with auto production.

Although Japan's gasoline vehicle output is modest in comparison with China's, the two countries use similar amounts of rhodium, each accounting for roughly a quarter of total world demand. Average rhodium loadings on Japanese-built cars are much higher than similar vehicles manufactured in most other locations, reflecting tight local emissions standards and the conservative approach of Japanese auto makers to the pgm mix in their catalyst systems. After some thrifting in the last two to three years, average rhodium loadings in Japan appear to have stabilised.

North America has seen aggressive rhodium thrifting in recent years, but there is now little scope to further reduce loadings. This year, demand will be supported by overall growth of around 3% in light duty gasoline output, although a shift towards smaller average engine size will limit the potential for a rise in rhodium offtake.

In Europe, the diesel sector has borne the brunt of recent declines in vehicle output, and gasoline car production will fall only modestly this year, leaving rhodium use little changed.

Other Demand

Net sales of pgm to the glass sector contracted sharply in 2012, as metal was returned to the market following the closure of obsolete marble melt facilities in China. This year, we expect demand to bounce back, as Chinese glass makers purchase metal for new glass fibre and display glass plants. This will more than offset some returns of pgm from shuttered LCD plants outside China. Rhodium in particular will benefit from a continued shift by glass fibre manufacturers towards alloys with a higher rhodium content, which provide significant technical benefits. At current rhodium prices there is a strong financial incentive in favour of alloy swtiching.

The use of rhodium in chemical applications is forecast to remain at historically high levels this year, supported by further purchasing of rhodium process catalysts for use in new oxo-alcohol and acetic acid plants.

Demand in other applications will also be unusually strong, mainly thanks to fresh investment in the Deutsche Bank rhodium ETF which was launched in May 2011. This

Rhodium Demand by Application
'000 oz

	2011	2012	2013
Autocatalyst	715	790	801
Chemical	72	81	79
Electrical	6	6	7
Glass	77	31	40
Other	38	66	89
Total Gross Demand	**908**	**974**	**1,016**
Autocatalyst Recycling	**(277)**	**(252)**	**(281)**
Total Net Demand	**631**	**722**	**735**

fund saw steady demand during the first nine months of 2013, with investors purchasing 41,000 oz over this period; total holdings exceeded 94,000 oz at the end of September. Including some additional demand for small rhodium bars, which are manufactured in Europe for the North American and European markets, we expect net rhodium investment to total approximately 65,000 oz in 2013.

Supplies

Production of rhodium in South Africa should be broadly flat in 2013; although the industry has suffered less disruption from strikes than last year, a series of shaft closures, lack of investment and poor productivity have all had a negative impact on the industry's capacity. In the last two years, four mines have been mothballed, all of which exploited primarily or exclusively the UG2 reef, which typically contains more rhodium than Merensky or Platreef. As a result, the impact of these closures on rhodium output has been relatively greater than on platinum or palladium.

OTHER PGM

After a weak performance last year, ruthenium demand should rebound strongly in 2013, although offtake – at 828,000 oz – will remain well short of the 2006-2007 peak, when demand exceeded one million ounces annually. Iridium purchases will be little changed, at 198,000 oz, but still significantly lower than the levels seen 2–3 years ago.

The hard disk industry is by far the largest single user of ruthenium, currently accounting for over 35% of total consumption. Last year, the sector struggled to recover from the catastrophic floods which disrupted Thai disk production in 2011, at a time when sales of hard disk drives were starting to falter under pressure from the increased popularity of tablets and smart phones. Manufacturers drew on ruthenium inventories to meet their production needs, causing a sharp drop-off in net sales to the industry. In 2013, the hard disk sector remains under pressure, with strong demand for 'enterprise' hard disk drives failing to compensate for lower PC sales to consumers. Nevertheless, with industry stocks now depleted, we expect ruthenium sales to hard disk producers to more than double.

In the chemical sector, there has been no repeat of the exceptional ruthenium demand seen in 2011, when large quantities of metal were bought by ammonia producers. Purchases of a ruthenium-iridium catalyst used in acetic acid production have also been limited, although a fresh round of capacity expansion in China looks set to generate some additional demand in the near future. Overall chemical industry demand for both metals will be little changed in 2013.

Ruthenium Demand by Application
'000 oz

	2011	2012	2013
Chemical	273	101	104
Electrical	536	361	531
Electrochemical	130	127	125
Other	58	72	68
Total Demand	**997**	**661**	**828**

In recent years, the electronics industry has purchased large quantities of iridium in the form of crucibles, in order to meet demand for single crystal sapphire used in light-emitting diodes (LEDs) for backlit LED TVs. Sufficient capacity is in place for the time being, and iridium demand has stabilised at the level required to replace process losses from existing installations. However, the use of iridium salts to make blue phosphors for organic light-emitting diodes (OLEDs) is now starting to show growth, albeit from a low base.

We have revised our 2012 estimate of iridium consumption in other applications, to account for strong growth in the use of this metal in automotive spark plugs. Demand has been lifted by rising gasoline vehicle output, and wider adoption of premium spark plugs in general and plugs with iridium electrodes in particular.

Supplies

On-going difficulties in the South African platinum mining sector will restrict output of ruthenium and iridium this year. Like rhodium, these metals are disproportionately affected by the shutdown of UG2 shafts, because UG2 tends to be comparatively rich in minor pgm. However, demand for both metals remains well below recent peaks, and these markets should be adequately supplied from primary mine production.

Iridium Demand by Application
'000 oz

	2011	2012	2013
Chemical	19	19	20
Electrical	195	27	36
Electrochemical	76	70	59
Other	42	78	83
Total Demand	**332**	**194**	**198**